THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. OCTOBER 12, 1899. CHICAGO, ILL. NUMBER 41

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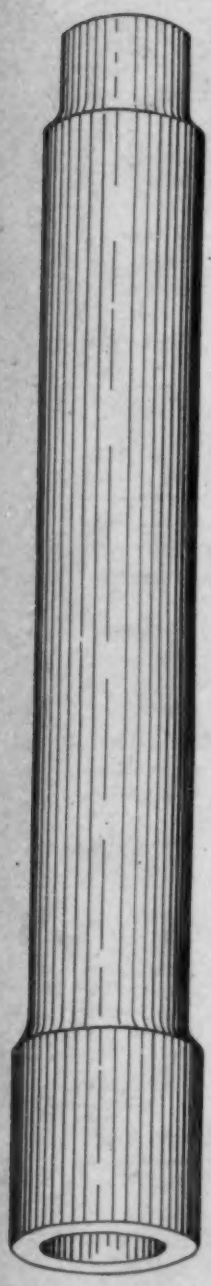

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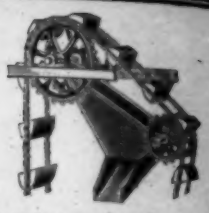

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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. OCTOBER 12, 1899. CHICAGO, ILL. NUMBER 41

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The base of the iron trade, iron ore and kindred interests, is just now the scene of important negotiations, with other developments pending that will bear in an important way upon the situation for next year. In connection with the announcement that the Bessemer Steamship Co. (Rockefeller) has acquired the American Steel Barge Co.'s fleet of 10 whaleback steamers and 20 barges, it is reported that negotiations for vessels by important ore interests are in progress. There is also more figuring on iron mine purchases by consumers. Ore buyers meantime are seeking to have prices fixed for next year, and while sellers as a rule are deferring the question and waiting for clearer light on probable production and consumption, it seems quite certain that a record for early sales will be made this year. At the other end of the market the manufacturer and the buyer of finished material are working out the solution of the problem presented by the high level of pig iron and steel billets. Sales continue to be made by the mills for next year in line with the top prices for pig iron and intermediate material, yet both buyer and seller feel that these are too high to be made the basis of a year's business. Just where the line will be drawn between the present level and the new level which it is felt must be established for sustained, healthy trading no man knows. Manufacturers of finished material are evidently exerting themselves in favor of a conservative course, and are quoting on deliveries in the second quarter of 1900 prices that presuppose a lower price for billets than that of to-day. So little steel now gets upon the market, in view of the consolidations of interests, that the billet has practically disappeared as a maker of prices for rolled products. Rails naturally have first attention in calculations for the coming year. Sales of 20,000 tons were made at Chicago the past week for next year, presumably at $33. It is estimated that nearly 300,000 tons have been sold in recent weeks for delivery next year and that enough deferred deliveries go over to bring the total between 600,000 and 700,000 tons. Thus, it does not appear that the billet supply will have any early reinforcement by the turning of rail mills on to billets. There are evidences that here and there the finishing mills are gaining on their order books and are able to make better promises of deliveries. But this is not yet a factor of any great moment. Judged by the aspect of the pig iron market there will be no change from the present high level for months to come. A sale of 10,000 tons of Bessemer iron is reported at $23.50 at valley furnace, and this is the minimum price to-day. The pace of buying in foundry iron is slackened for the moment, after two months of very active business. Yet in the Chicago district one large buyer's requirements were covered in the week, and in the East sentiment seems to have reached the strength previously attained in the Central West. In general, transactions on the seaboard have been on a higher level than in the week immediately preceding. The scarcity of Connellsville coke is still a disturbing factor. Two Northern Ohio furnaces had to bank on this account the past week and nearly all in the valleys are simply going from hand to mouth.

PITTSBURG.

OFFICE OF *The Iron Trade Review and Industrial World.*
705 PUBLICATION BUILDING, Oct. 11.

Interest in the iron and steel market centers on the Bessemer pig iron situation. While the week has been a quiet one, the uppermost question is as to the ability of the furnaces to turn out the quantity of Bessemer iron which will be required for the steel capacity for the first six months of next year, which it seems probable will have to be more fully exercised. The purchases of iron for the first half of next year, and in some cases for the first three quarters, by leading steel interests, are taken as an expression of confidence in the situation. At the same time there is not sufficient information at hand as yet as to probable consumption during next year, and information is eagerly sought bearing on this question. The rail manufacturers are making, through their sales agents, a thorough canvass of the situation as to the probable needs of railroads in 1900 and their attitude on the price question, and the outcome of the investigation will doubtless be the formation of a comprehensive policy in the matter. In the present year it was the selling of large quantities of rails at prices which at the present time seem ridiculously low that formed the foundation for the present high prices, but the large steel concerns which make rails do not feel willing to sacrifice anything in order to make next year a good one, and are disposed to get a fair price for the rail tonnage of 1900, believing that there will be more than ample demand for all the steel capacity, whatever form the finished material takes. There has been a considerable tonnage of Bessemer steel sold for next year, but not much as compared with finished material in various lines. It is the policy of the different steel companies to withdraw as much as possible as sellers of billets, blooms and slabs and the lot of rolling mills which purchase raw material in this form seems likely in the near future to grow harder and harder.

A very important feature of the general situation which is being watched by the farthest-sighted in the trade, is the growing tendency to produce basic open-hearth steel as against acid Bessemer. Beyond the basic open-hearth furnaces recently put in operation a number more are projected. It will be remembered that originally the manufacture of basic open-hearth steel was started in this district largely to furnish an economical use for the scrap produced in the manufacture of Bessemer steel, and to take advantage of low prices for Southern high phosphorus pig iron. The conditions are now not the same as they were then. With basic open-hearth manufacture constantly increasing, with no corresponding increase, or in fact no noteworthy increase at all in Bessemer capacity, while at the same time Alabama proposes to manufacture basic steel itself from its pig iron, the aspect of affairs is changed. Besides this the demand for scrap has greatly increased from mills producing iron. The least that will come of the present situation will be a change in the technics of manufacture, rapidity in the operation of basic open-hearth furnaces coming from the use of direct metal from the furnaces rather than from the use of scrap. As an adjunct to the manufacture of Bessemer steel, the manufacture of basic open-hearth steel has been very advantageous and profitable; the position of the process when it has to stand by itself will be watched with great interest.

The general trend of pig iron prices has been toward a

higher level, and there are not wanting those who prophesy wonderfully high prices for Bessemer iron, figures as high as $30 and $35 being mentioned. In steel there has been some booking of orders for blooms, slabs and billets for next year, but a number of producers are holding entirely aloof. In finished material there has been continued selling for next year but at prices only slightly changed from those ruling for some weeks past. Last Friday the manufacturers of chain met in New York and advanced prices something like $5 a ton. The new prices run from $4.40 for 1⅛ inch to $8.75 for ⅞ inch, for proof coil chain, in casks of not less than 1,000 lbs. of a size, with B. B. crane chain 1¼c a pound higher, B. B. B. crane chain 1¾c higher, dredge chain 4¾c higher, railroad chain to requirements and tested ½c higher, and railroad brake chain with eye-bolts ½c higher than proof coil chain. For less than full casks of 1,000 lbs. to a size ¼c is added, this as a reasonable protection to the jobber.

Pig Iron.—There has been something of a lull in Bessemer pig iron buying. It is now learned that in the matter of the sales of 113,000 tons of iron to a leading Western interest, a hitch occurred after the sale was practically consummated, and 50,000 tons of the lot it was found could not be delivered, so that the total to this interest stands at 63,000 tons. Total sales since the first of September aggregate about 150,000 tons for next year, a small quantity being Pittsburg iron and the balance Valley. Prices to-day range from $23.25 to $23.50 Valley for the first half of next year, and from $23.75 to $24 for delivery this year, there being little Bessemer to be had for delivery this side of April 1 next. In foundry iron prices have advanced, although there is no pressure for spot shipments, owing to the tie-up of Pittsburg foundries from the strike of molders and coremakers which continues without decided advantage on either side. In gray forge the situation continues firm, without change in prices. We quote the market as follows for delivery during the first half of next year, it being understood that premiums generally have to be paid for any deliveries this year, amounting to from 50 cents to $1 a ton in the case of Bessemer and foundry iron:

Bessemer, valley furnace	$23.25	to	23.50
Bessemer, Pittsburg	24.00	to	24.25
No. 1 Foundry	23.50	to	24.00
No. 2 Foundry	22.75	to	23.25
No. 3 Foundry	22.00	to	22.50
Gray Forge, valley furnace	21.25	to	21.50
Gray Forge, Pittsburg	21.00	to	21.50

Steel.—There has been selling by some interests, of slabs and billets for the first half of next year, but the transactions are carefully guarded. It is understood that from $38 to $40 has been paid. For delivery this year nothing under $40 can be done, and there are only a few stray lots here and there which can be picked up. There is considerable difference of opinion among steel mills as to the advisability of selling material in this form next year, and the situation is being carefully canvassed, and when investigations have been completed it is probable there will be more important transactions. For basic open-hearth material nothing lower than $50 can be done, for delivery either this year or next, and the market is in strong hands.

Ferro-Manganese.—Prices are very strong in this line, and nothing below $100 can be done for 80 per cent, in moderate quantities, while prices very much above this have been paid for small lots.

Rails and Track Material.—The rail makers are carefully canvassing the situation, and are endeavoring to forecast the quantity of rails the railroads will probably need, and the price they would be willing to pay. Decisive action by the association, or by individual makers, is expected in the near future. Meanwhile there has been some selling of rails for next year, the total amounting probably to over a quarter of a million tons. The price at which this tonnage has been booked is somewhat in doubt, but scheduled rates remain at $33 for 100-ton lots and over, $34 for carloads to 100 tons, and $35 for less than carloads, for standard sections. Light rails continue to command a very large premium. In track materials there continues to be a good demand at former prices, which are firmly held. We quote as follows: Spikes, 2.60c to 2.75c; track bolts, square heads, 3 10c; hexagon heads, 3.25c; splice bars, 2.50c to 2.60c; links and pins, 2.70c to 2.75c.

Bars.—The demand continues active, with prices in the neighborhood of 2.50c for steel bars for 1900. For shipment in 60 days as high as 2.75c has been paid on small lots The situation in iron bars made from all-muck stock is strong, and we quote 2.50c upward, according to delivery.

Structural Material.—Except at a decided premium, nothing can be done in structural material except for delivery from three to four months ahead, the premium for earlier delivery often amounting to several dollars a ton. We quote the scheduled prices unchanged as follows: Beams and channels, 3 to 15 inches, 2.25c; 18 to 24 inches, 2.35c; tees, 2.30c; zees, 2.25c; angles, 2.25c. Universal mill plates are quoted at 2.75c to 2.90c.

Plates.—The situation in plates is a trifle stronger than last week. Some producers are pretty well filled for the first quarter of next year. There is a decided difference of opinion in the matter of prices, some mills quoting prices for the second quarter a shade lower than for the first quarter, and others quoting fully as high prices, or even refusing to quote altogether. For shipment this year nothing below 3c can be done on tank plate, with other grades in proportion, while we note a sale of 25 tons of tank plate, ⅜ inch and heavier, at 3.25, for shipment within 30 days. We quote as follows for next year, according to delivery: Tank, 2.80c to 2.90c; shell, 2.90c to 3c, flange, 3c to 3.10c; fire box, 3½c to 4c.

Pipes and Tubes.—Demand for merchant pipe, casing and boiler tubes continues very good, with prices about as last quoted. Deliveries can generally be secured within a month or six weeks' time. We quote the market strong as follows: Merchant pipe, 50 and two 10's for carloads and 50, 10 and 5 for less than carloads, carloads being delivered within the specified territory and less than carloads being f. o. b. mill; well casing, screw and socket joint, 40; inserted joint, 35, with an optional 5 per cent to dealers only; boiler tubes 1¼-inch to 1½-inch, 40 per cent off; 1¾-inch to 2½-inch, 50 per cent off for iron, and 55 per cent off for steel; 2¾-inch and larger, 52½ per cent off for iron and 55 per cent off for steel, with 5 per cent additional in carloads, less than carloads being f. o. b., mill.

Sheets.—No authoritative information can yet be secured on the sheet consolidation. The options taken expire Nov. 1, and as it is generally understood that these were at figures lower than could be duplicated now, there is reason to believe that the deal will be put through, although the present condition of the money market is very much against the floating of new corporations. The market for both black and galvanized sheets is somewhat firmer than as last reported. There has been a wide range of quotations on black sheets, but now for No. 28 we quote 3.25c to 3.35c. In galvanized the situation is also a little stronger than last week, and it would be decidedly difficult to secure anything below 70 and 10 per cent, with a 15-cent freight allowance.

Spelter.—Spelter is a trifle firmer, and we quote prime Western grades at 5 50c, Pittsburg. Nearly all the ore mines have been closed down for a few days, but owing to accumulation of stocks no difficulty has been experienced by smelters. Conditions seem to be ripe for a decided advance in the metal, as the ore miners have made a good showing of strength.

Old Material.—The market for scrap iron continues to be decidedly irregular, and prices are difficult to quote. In some lines there are considerable stocks in the hands of consumers, but the yards are not well filled. We quote prices as follows: Pittsburg, gross tons, except where otherwise specified: Steel rails, mixed lengths, $19 to $20; short lengths, $20 to $21; iron rails, $26 to $27; cast borings, $11.50, net tons; cast scrap, $17.50; No. 1 wrought scrap, $19 to $20, net tons; busheling scrap, $15 to $16, net tons.

Coke.—The scarcity in the matter of car supply is almost as bad as it has been for the past two or three weeks, and no great relief is in sight. Deliveries are made as fast as cars can be secured, and there has been no cessation of operations. Stocks continue to accumulate in the coke region, awaiting shipping facilities. There is very little coke to be purchased, and the market is strong at $2.75 for furnace and $2.75 to $3 for foundry, for strictly Connellsville coke. Dealers in foundry coke are in cases asking much higher figures.

CHICAGO.

Office of The Iron Trade Review and Industrial World.
1522 Monadnock Block, Oct. 11.

Notwithstanding the fact that the celebration of Chicago Day occupied a great deal of attention the latter part of last

week and the first of this, a considerable amount of business was done in almost every line. The demand for material of all kinds continues heavy, and sales were larger in the week just ended than in the previous week. Prices continue about as they were a week ago, with advances on some grades of iron and steel

PIG IRON.—There were a larger number of inquiries in the Market last week than has been the case for a long time past, although the tonnage wanted has been exceeded recently. Small buyers made considerable purchases, in the aggregate, and included in the week's business were several lots of considerable size. Two or three of the larger buyers were in the market, and at least two of them made purchases. One sale of about 5,000 tons was made to an agricultural implement concern, and a sale of something less than 10,000 tons was made to another buyer. Almost no iron is to be had for anything like immediate delivery, and where furnaces are able and willing to take orders for delivery within the next two or three months, for small lots, they secure considerable advances on the market prices. The market has been steady, with no changes in prices, but it is very firm, and quotations are expected to be higher before long. Prices are made as follows:

Lake Sup. Charcoal	$24 00@$26 00	Southern Coke No. 3	$21 65@$22 15
Local Coke Fdy. No. 1	23 50@24 00	Southern No. 1 Soft	23 65@24 15
Local Coke Fdy. No. 2	23 00@23 50	Southern No. 2 Soft	22 65@23 15
Local Coke Fdy. No. 3	22 50@23 00	Southern Silveries	26 50@27 00
Local Scotch Fdy. No. 1	23 50@24 00	Jackson Co. Silveries	24 00@25 00
Local Scotch Fdy. No. 2	23 00@23 50	Ohio Strong Softeners	23 00@24 00
Local Scotch Fdy. No. 3	22 50@23 00	Alabama Car Wheel	25 00@26 00
Southern Coke No. 1	23 65@24 15	Malleable Bessemer	23 50@25 00
Southern Coke No. 2	22 65@23 15	Coke Bessemer	24 00@25 00

BARS.—There was a large demand for both iron and steel bars in the week, and sales were in excess of those of the week before. Several order of large tonnage were closed, and further large business is in sight for the immediate future. Nearly all of the business being done is for delivery in the first half of next year. Common iron is quoted at 2.30c to 2.40c, and soft steel bars at 2.30c to 2.40c, half extras.

CAR MATERIAL.—There are several quite large lots of cars in the market which will likely be closed within a short time. Last week the market was quiet, with little doing. The demand for car material was also small.

STRUCTURAL MATERIAL.—Business last week was limited to small lots. The demand is light, and nothing large is in sight. Prices are as follows: Beams, 15 inches and under, 2.40c; 18 inches and over, 2.50c; angles under three inches and over six inches, 2.50c; three inches to six inches, 2.40c; sheared plates, 3.15c to 3.25c; universal plates, 3.15c to 3.25c; tees, 2.45c; zees, 2.40c; small lots from store are quoted from ¼c to ½c higher.

PLATES.—There has been no change in conditions. The sales of the week were small, the mills not being able to accept much business. Prices are made as follows: Tank steel from store, 3.40c to 3.50c. Mill shipments, Chicago delivery: Tank steel, 3.25c; shell, 3.35c; flange, 3.40c; marine, 3.40c; fire box, 4c to 6c, according to brand.

MERCHANT PIPE.—The demand is still too large for the mills to supply and local stocks are rapidly being depleted. Quotations are unchanged at 50 and 10 and 10 per cent discount.

SHEETS.—Business last week was not especially large, although there were several good orders placed. No. 27 black sheets are unchanged at 3.30c to 3.40c, and galvanized at 70 and 10 to 70 and 5 per cent off.

MERCHANT STEEL.—Sales of the week included several good sized contracts for delivery in the first half of next year, and this, with general business, made the aggregate tonnage for the week large. The demand seems likely to continue for some time. Smooth finish tire steel is quoted 2.80c to 3c; smooth finish machinery steel, 2.95c to 3.05c; spring steel, 3.65c to 3.75c; tool steel, 7c to 7.50c; special, 13 50c and upwards

BILLETS AND RODS.—The local mills closed contracts for about 30,000 tons of steel last week. Other sales in this territory were not large. Bessemer billets are worth about $38 to $40, Chicago; rods, $50, and sheet bars, $38 to $40.

RAILS AND TRACK SUPPLIES.—Orders for about 20,000 tons of rails were taken by the local mills last week, and considerable business was done in this market by other mills. The total sales of rails so far are estimated to be above 300,000 tons. Quotations are as follows: Rails, standard sections, $33 to $35; light sections, $34 to $40; splice bars, 2.50c to 2.70c; spikes, 2.65c to 2.75c; track bolts, 3.65c to 3.85c.

OLD MATERIAL.—The demand continues, with only a limited supply, so that sales have not been large. Local dealers are finding it difficult to keep up with their orders for material. Selling quotations are about as follows:

Old iron rails, gross	$28 00@$30 00	Axles, net	$31 00@$32 00
Old steel rails, long, gr.	24 00@25 00	Cast borings, net	10 50@11 50
Old steel rails, mixed	19 00@19 50	Wrought turnings, net	12 00@12 50
Old wheels, gross	21 00@22 00	Axle turnings, net	13 50@15 00
Railroad forge, net	23 50@24 00	Mixed steel, gross	14 00@15 00
Dealer's forge, net	17 00@17 50	Stove plates, net	11 00@11 50
No. 1 mill, net	15 50@16 50	Heavy melting steel, gr	18 50@19 00
Heavy cast, net	16 00@17 00	Old iron splice b., net	21 00@22 00
Malleable cast, net	14 00@16 00		

WIRE AND WIRE NAILS.—Sales last week were large, and the demand is by no means satisfied, even temporarily. Mills report sales of about their weekly output every week. Quotations are strong and unchanged. Makers quote single carloads of wire nails at $3.10 f. o. b. Chicago, and $3 20 less than car loads. On wire current quotations are as follows: Plain annealed wire, $2.95; painted barb wire, $3.55; galvanized barb wire, $3.70.

CLEVELAND.

OFFICE OF *The Iron Trade Review and Industrial World.*
27 VINCENT ST., Oct. 11.

Cleveland vessel and iron ore circles give indications of not a little ferment, mostly under the surface. There is much figuring for next year, both on ore and vessels. Consumers of ore are asking what prices are to be for 1900. Shippers are attempting to get some basis for an answer, either by sounding vessel owners, or by getting in a secure position on the freight question through the ownership of their own carriers. There is not a little negotiating for vessels, and the announcement has been made in the past few days that the Oliver Iron Mining Co., in other words the Carnegie Steel Co., Ltd., had acquired control of the American Steel Barge Co. and thus had secured the 10 whaleback steamers and 20 barges of the latter company. It is known that both the Carnegie and the Rockefeller interests, the latter as represented in the Bessemer Steamship Co., have been negotiating for a majority of the American Steel Barge Co. stock, carrying with it a block of American Ship Building Co. stock given in exchange for the West Superior ship yard and equipment. The American Steel Barge Co. also owns a considerable amount of stock in the Lake Superior Consolidated Iron Mines, and the shipyard at Everett, Washington. It is understood, further, that there has been rather keen competition between the Carnegie and Rockefeller interests for the whaleback fleet; but the indications now are that the purchaser is not the Carnegie-Oliver mining company, but the Bessemer Steamship Co. Details are not obtainable, but the situation is likely to develop more clearly in the near future. Meanwhile rumors are plentiful as to negotiations for the purchase of vessels, and the local ore and vessel contingent are on the qui vive for developments.

Concerning charters for next year there is more discussion than might be expected with the close of navigation six weeks off. Vessel men talk $1.25 from the head of the lake, but there are no authenticated offers at that figure. Unquestionably the feeling among shippers has undergone some change in the past few weeks, and they are more confident of their ability to charter on a basis nearer $1 than $1.25. Vessel control by interests that have taken large blocks of tonnage in the open market heretofore is causing some revision of ideas also among vesselmen. More new vessels are expected also.

Shipments of ore to Oct. 1, as shown by the official figures of ore men, were 13,016,219 tons, as against 10,994,201 to Oct. 1, 1898, a gain of 2,022,018 tons. A total approximating 16,000,000 tons is now in sight. As to the situation with furnacemen in the early spring, much will depend, in the case of those who now figure that they are short on requirements, upon how much ore they may be able to buy from consumers whose habit is to buy a supply from July 1 to July 1. As to the shortage on sales and contemplated shipments there is no reason to change statements heretofore made. The late sales of ore in 10,000 and 20 000 ton lots from mines recently put in shape to produce a small amount before the end of the season, were in some cases at practically double the price secured at the opening of the season for similar ores. Sellers as a rule are not expressing themselves as to next year's prices, realizing that in the case of old range Bessemers, at least, this is not a matter for individual initiative.

Estimates from the mines as to the probable production for the coming year are yet to come down. It is certain that the physical condition of some of the well known properties will not permit a larger output next year than this, no matter what the labor supply may be.

PIG IRON.—No further sales of Bessemer iron have been reported in the past week, apart from one of 10,000 tons made by one steel consolidation to another, the price being $23.50 at valley furnace, or $1 above the basis of the larger association sales. The negotiations for a further large sale, referred to last week, did not come to a transaction. The supply of Bessemer from merchant furnaces is likely to prove uncomfortably limited for the first half of next year, and beyond what is now nearing completion there is little prospect of any considerble relief from projected furnace capacity short of the closing months of 1900. Buying of foundry iron is lighter in the local market. The general basis is $22 to $22.35 in the valley for No. 2 for next year, but small lots for early shipment have brought as high as $24 at furnace. Gray forge is firm and very scarce, but the quotation is not changed:

Bessemer	$24 00	Valley Scotch No. 1	$23 00@23 50
No. 1 Strong Foundry	23 00@23 50	Valley Scotch No. 2	22 25@22 75
No. 2 Strong Foundry	22 50@22 75	Gray Forge, valley	21 50@21 50
No. 3 Foundry	21 50@22 00	Lake Superior Charcoal	24 00@25 00

FINISHED MATERIAL.—The current of demand for rolled material continues strong for early deliveries, and contracts for next year are being made week by week. Some buyers are covering for only the first quarter of 1900, being disposed to follow prices, rather than to help make them. In general the demand continues to hold prices on the high level, with a wider difference in some lines between farther future and present or near future deliveries. On steel bars, for example, 2.25c has been done for shipments after April, 1900, while sales for several weeks past have been made at 2.50c for the first two or three months of next year. Mills in some instances appear to be making some progress out of the condition of serious congestion that prevailed in the summer and can take care more promptly of specifications on contracts. For bar iron we continue to quote 2.15c at Youngstown mill, with additional charges for cutting and for assorted sizes. Out of stock, Cleveland, the price is 2.50c, with full extras. In sheets there is a somewhat wide variation between quotations, due to the differing states of order books. On No. 27 Pittsburg mill quotations are from 3.10c to 3.25c for black sheets. On galvanized fairly prompt deliveries are possible. We quote 70 and 10 per cent. Pipes and tubes are a trifle higher for mill shipments. Out of local stock 50 and 10 to 50 per cent is the price on small lots. The plate market shows some variation in prices, far forward deliveries being from $2 to $4 a ton below the basis for this year. We quote tank at 3c, Cleveland, for this year's delivery. It is reported that two additional steel steamers for the Wolvin fleet, Welland canal size, with 3,000 tons capacity, have been placed with the American Shipbuilding Co.

OLD MATERIAL.—Prices are firm, with a rising tendency in some lines. We quote old iron rails at $27 to $29. valley; old steel rails, $20 to $22; No. 1 railroad wrought scrap, $20; old iron axles, $27 to $28; old car wheels, $19 to $20; machinery cast scrap, $16 to $17; wrought turnings, $12.50 to $13; cast borings, $11 to $11.50.

CINCINNATI

Oct. 10.

Rogers, Brown & Co. say: "The scarcity of iron for immediate delivery, on fresh orders, is keenly felt and the consequent discomfiture of both buyers and sellers is pronounced. There is no disposition on the part of the furnaces to raise prices to an extraordinary plane, and it is fortunate that the utmost conservatism is beinng exercised by the producers. The proof of the present comparatively high prices being legitimate, is afforded in the fact that the professional and sporadic speculators have been conspicuous by their absence, and the trade generally appreciate the fact that the current figures are elevated by the inevitable force of extraordinary demand over limited supply. The foreign demand for American machinery, tools and implements of nearly every kind and metal products of every variety, keeps up remarkably, notwithstanding the advanced prices at which these products are selling. Prices have not risen much aside from Bessemer and Southern No. 4 foundry, the latter being marked up 25 cents above the selling figures of last week. The inadequate car supply continues to be a source of annoyance, inconvenience and loss to producers and consumers alike. It is hoped that the prosperity of the railroads will enable them to add to their rolling stock a more adequate equipment for the expanded business. The market closes firm with still an upward tendency for quick deliveries." We quote for cash f. o. b. Cincinnati: Southern coke, No. 1 foundry, $21.75 to $22.75; No. 2 foundry, $20.75 to $21.75; No. 3 foundry, $19.75 to $20.75; No. 4 and gray forge, $19.25 to $20.25; No. 1 soft, $21.75 to $22.75; No. 2 soft, $20.75 to $21.75; Lake Superior coke, No. 1, $24 to $24.50; No. 2, $23 to $23.50; Hanging Rock charcoal, No. 1, $25 to $26; Jackson Co. silvery, No. 1, $30 to $31; standard Georgia car wheel, $22.25 to $23.25; Lake Superior charcoal, $25 to $25.50.

Matthew Addy & Co. comment as follows: "The small buyers are having their innings these days. They have been purchasing pretty steadily in small lots for all kinds of deliveries and paying of course the full market prices. Some of the larger concerns have come into the market, secured prices and then have failed to buy, stating they had taken their chances so long that they thought now they could afford to keep on taking them Every week, however, makes the stringency of the situation more and more evident. The slightest increase in demand at the present time would put iron up $2 or $3 a ton without the slightest difficulty. For instance, last week one of the large combinations triedto buy several thousand tons of Southern gray forge for quick shipment. They were able to pick up two or three lots for shipment during the balance of the year, but all the iron they could secure did not equal one-third of the quantity that they desired. They quietly withdrew from the market instead of holding out premiums to obtain what they could only secure by robbing somebody else. The buyers who are taking chances on the market are really taking very decided chances, particularly when they remember that the largest Southern producer is to-day behindhand on every grade of iron it makes, from 27,000 tons down to 200 or 300 tons of the grades that are not in active demand."

PHILADELPHIA.

Oct. 10.

Demand is again more urgent and prices are higher. There is still some figuring on export pig iron, showing that England is willing to buy certain brands of soft Southern foundry irons, having become accustomed to their use. Owing to the selling price at the furnace, added to rail and water rates, however, we are barred out for the present. Certain quality of low-phosphorus foreign iron is now being shipped to Pittsburg. This is owing to the famine here in low phosphorus metal. The great problem now is the question of car supply, which commences with the ore and coal as it comes from the mines and extends to the movement of pig iron and products therefrom. The general aspect of the pig iron market is of renewed strength and activity. Some good blocks of iron have been sold at full prices. Everything is so close sold up that there is no inducement for sellers to extend their lines unless at prices which are amply satisfactory. Consumers must have very heavy requirements, otherwise they would not bid for such large lots and such extended deliveries. This applies to every department of the iron and steel trades. Sales for next year's delivery have been made on the basis of today's prices, and the indications are that makers will ask more money if buyers insist upon increasing their lines. There is no doubt that whatever of hesitancy there may have been during the past week or two is giving place to confidence, which is likely enough to develop a higher range of prices before many days. It has been quite well established in the past few days that the trade does not look for lower prices in the coming year than are now prevailing. We quote a trifle higher basis for pig iron than last week. Little No. 2X foundry is to be had for less than $22.75; some makers quote $23 to $23.25 at Philadelphia and near-by points. In billets, $38 to $39 is still the basis for next year's deliveries, with prompt steel $2 a ton higher. Muck bars are quoted $32.50 to $33.50. Buyers of finished material are taking a fresh hold apparently, accepting quotations promptly where reasonably close deliveries can be made. We quote: No. 1X foundry, $23 to $24; No. 2X foundry, $22.50 to $23; No. 2 plain, $21.50 to $22; Gray Forge, $19.50 to $20; best refined bar iron, 2.15c to 2.20c; tank plates, 3.10c to 3.15c; angles, 2.38c to 2.50c; beams, channels and tees, 2.43c to 2.60c; sheets Nos. 10 to 14, 3.10c to 3.20c; sheets Nos. 18 to 20, 3.30c to 3.40c; sheets Nos. 21 to 27, 3.50c to 3.60c; sheets Nos. 28, 3.70c to 3.80c.

LAKE SUPERIOR IRON MINES.

The Duluth & Iron Range Railroad has ordered 10 new locomotives and 300 new steel ore cars for delivery in the spring of 1900. The ore cars will have a capacity of 56 tons each and 26 of them will make a train equal in capacity to 43 cars of the present size. The improvement of grades on the Duluth & Iron Range road has increased the tonnage of trains by 70 per cent.

At the Mansfield mine the ore has been followed in the lowest level for a length of 220 feet, the width of the deposit averaging from 15 to 20 feet. This is the only property in the Crystal Falls district producing ore of Bessemer grade. The mine now makes the best showing in its history.

At the Champion mine on the Marquette range an output of 225,000 to 250,000 tons is expected this year. It is nine years since such a total was reached. Last year's output was 163,000 tons and was in excess of several years preceding. *Iron Ore* says: "The Champion is looking well in the west end of the mine, but unfortunately the ore is still high in phosphorus. Up to a year ago phosphorus bothered this company but little, every pound of ore mined being of Bessemer grade. In the ground opened to the west in the lower levels, and during the past year, the phosphorus has increased materially, and but for the present demand for ore which overlooks much that was formerly objectionable, the company would be seriously handicapped. The Champion is a deep mine, has much dead work to do, its ore is very hard, and it requires competent direction to keep the cost per ton down to a point where a profit can be realized."

The Cleveland-Cliffs Iron Co. will resume operations at its Michigamme mine, which has been idle since 1891. The ore is a hard non-Bessemer.

The second cargo of ore has been shipped lately from the Davis mine at Ironwood, Mich. The manganese content has been 12 per cent in this ore thus far.

The Bucyrus Co., of South Milwaukee, is building a steam shovel for the Lake Superior Consolidated Iron Mines, which is intended to be the heaviest and most powerful yet built. It is to carry a 3½ cubic yard dipper which will be capable of dealing with the most difficult deposits on the Mesabi range. The Bucyrus Co. is crowded with orders.

A cargo of 8,215 net tons of ore (7,335 gross tons) was delivered at South Chicago from Two Harbors last week by the Minnesota Steamship Co.'s steamer Malietoa, recently completed at the Lorain works of the American Ship Building Co. The Malietoa was on an even keel drawing 18 feet ½ inch.

The Paint River mine in the Crystal Falls district has been acquired by Corrigan, McKinney & Co. The Monitor, which adjoins it, is operated by the same company.

The Oliver Iron Mining Co. has bought the Goodrich mine, located near the Saginaw, a few miles from Ishpeming, Mich. The Goodrich has shipped first and last about 50,000 tons, but has not been worked for several years. There is a large deposit of silicious ore running 50 per cent in iron and better; also a body of high grade hematite. The purchase of the mine includes a fee of 80 acres.

The work of moving the village of Eveleth, Mesabi range, has proved more of an undertaking than was expected, and mining on the property there, leased to P. H. Kimberly, has not begun. There will be shipments next year, however.

The Rust shaft house, at Hibbing, Minn., was burned recently, and the shaft somewhat damaged. Its destruction will probably close the mine for the season. The mine had been employing about 60 men and had shipped 50,000 tons this year.

The Colonial Iron Co. is now mining at the Hale and Kanawha, Mesabi range, and the former contract miners, Davis & Davis, are stripping on the location so as to make the mines a milling proposition next year.

The Barasa mine, Negaunee, Mich., now has an opened up body of high grade Bessemer ore, 18 feet wide, and its size increasing daily under development work. The Barasa adjoins the Negaunee mine.

By special car from Chicago and by special engine also on a portion of the Michigan and Minnesota trips a party composed of L. C. Hanna, of Cleveland, and W. E. Reis president, Henry Wick first vice-president, and R. M. Gilbert second vice-president of the National Steel Co., visited the newly acquired Chapin and Winthrop mines of the latter company last week. The trip was extended to the Mesabi range, Superintendent McNaughton of the Chapin mine accompanying the party on this portion. Improvements are to be made at the Winthrop mine with a view to increasing the output and delivering the ore in most suitable form to the furnaces. It is the purpose to install crushers.

There is no confirmation of the report that the Cary and Superior mines of the Odanah Iron Co., on the Gogebic range, have been acquired by the Federal Steel Co. These are indications that the properties will continue to be operated under the present auspices.

The Chandler mine will probably fall 50,000 to 100,000 tons short of the expected output. The total now counted on is 800,000 tons.

The Cuff mine, the American Steel & Wire Co.'s property in the Iron Mountain district, Menominee range, has made a beginning of shipments, 15,000 to 20,000 tons having been sent forward. The property will be opened up on an extensive scale the coming winter.

Personal.

Frank L. Hearne, general manager of the National Tube Co., and W. G. Mather, president of the Cleveland-Cliffs Iron Co., Cleveland, are named for election as directors of the Wheeling & Lake Erie Railroad at the next meeting.

The name of Col. Isaac L. Ellwood, second vice-president of the American Steel & Wire Co., has been brought out formally by his friends for the United States Senatorship from Illinois.

Geo. H. Fisher has been made manager of the Eagle mill at Ironton, O., succeeding Jacob James.

Andrew Carnegie has announced his intention to establish a library at Conneaut, O., the terminus of the Bessemer road and the location of the Carnegie ore docks.

Joseph Porter has been appointed manager of the Palmer Iron & Steel Co.'s mill at Muncie, Ind.

John N. Binnix, general superintendent of the works of the Central Iron & Steel Co., Harrisburg, Pa., died Sept. 30. He was 65 years of age and had been with the company since 1875.

William Cooke, of Paterson, N. J., who was a pioneer in the iron business in New Jersey, died Sept. 28.

Edward Bailey, of Harrisburg, Pa., has been elected president of the Central Iron & Steel Co., to succeed his father, the late Charles L. Bailey. James B. Bailey was elected to succeed Chas. L. Bailey on the board of directors and was made purchasing agent. Geo. R. Bentley, of Harrisburg, was elected to succeed the late John Nathan Binnix as general superintendent of the plants.

Two Busy Years Ahead for Steel Works.

President Felton of the Pennsylvania Steel Co. is quoted as saying: "This has been decidedly the best year in the history of the iron and steel trade, and in my opinion prevailing conditions will continue indefinitely. There are 7,000 men employed at the Pennsylvania Steel Co.'s works at Harrisburg, Pa., and 3,500 at Sparrow's Point. Every department of both plants is working to the full capacity, and some of them are running day and night, so great is the rush of orders. Our product is sold far ahead and we have booked orders for delivery in the middle of next year. We have enough work on hand to keep us busy day and night for the next six months, even if we do not book a single new order. Those who imagine that the present activity will subside by the end of the year do not understand the situation. In my opinion the plants of America will have all they can do for the next two years, without including the foreign trade, which is increasing at a gratifying rate. The position of the trade was never so strong as at present. Prices are higher than ever before, being 100 per cent. in excess of those of a year ago. This, however, is due to the great increase in the price of pig iron for which manufacturers of iron and steel products are not to blame; pig iron is up because it is scarce and in better demand than ever before."

The new blooming mill of the Lorain Steel Co., Lorain, O., was started for regular operation Oct. 9.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDR TRADES AND IRON AND STEEL MANUFACTURE.

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OCTOBER 12, 1899.

POSTPONING THE REACTION.

It has been suggested that the railroads may put the needed check upon iron and steel prices by postponing purchases so far as possible. There is some evidence that certain roads are doing this without any purpose of posing as conservators of the best interests of the iron trade. There is no doubt, moreover, that sundry other buyers would go on with undertakings they have planned, if prices were about midway between the starting point and what now looks to be the summit. But buyers who fear that they cannot get material when they want it for their operations next year, are determined to make sure of it and are helping to push to-day's prices farther into 1900 by contracting six, nine and twelve months in advance of current needs. The fact of the matter is that advances in price have apparently only increased the determination of buyers to cover and have had the opposite from the intended effect. There seems to be enough of this determined buying, moreover, to put the market for some months beyond the reach of the effects naturally expected from suppresion of consumption. As for the railroads, it does not appear that they have cause to put forth any heroic efforts to keep the iron market down. Having bought rails below panic prices, they could well afford to follow the market upward in their contracts for equipment. And even here their average prices are probably below the middle point between to-day's figures for cars and locomotives and those of one year ago. On the other hand, in their sales of old material they have got the benefit of prices in some cases considerably above those at which steel makers are delivering them new rails. On the equities of the situation the railroads could well afford to contract at $33 for their entire supply for 1900. As steel works are now circumstanced, a wait of several months by rail buyers would be no calamity. But in addition to the postponed deliveries of rails sold for 1899 and not to be rolled until after Jan. 1, a good beginning of buying has been made at $33.

Declarations that iron and steel prices are too high do not come to anything, when the situation is dominated by forces that cannot be fully identified, much less measured. It was said in April, when the present movement was only well started, that the danger point had been reached, and that prompt reaction, with its lengthening train of disasters would follow further advances. Yet pig iron has gone 60 to 70 per cent higher in the interval. The sense of the attendant danger is more acute, to be sure, as the altitude increases, and on all hands it is appreciated that every advance hastens the end. The discussion of ways and means of averting the impending disaster, as intimated in the opening sentence above, is already under way. The *Engineering News* is among those who, alarmed at 10 months of advancing prices, would seek a remedy. It refers to the familiar sequel of all such periods of rapidly ascending prices and then asks:

> What can be done to postpone this evil day, and to diminish its shock and its intensity when it does come? The almost self-evident answer is that anything at the present time which tends to check the swelling tide of demand, the forcing upward of prices, and the increasing tendency toward debt-incurring and speculation on a gigantic scale, will operate to prolong prosperity. Let us illustrate by a concrete example. Here is, let us say, a city which proposes to spend ten million dollars on certain public improvements. These have been a long time in contemplation; but during the hard times the taxpayers have been inclined to oppose such large expenditures. Now, under the general stimulus of prosperity, however, it is proposed to undertake the work. The money is raised by the sale of city bonds, and this volume of demand is added to that which is at the present time operating to raise prices of materials and of labor to a still higher point. Next, suppose that instead of this course the opposite one were taken, and the work were postponed until a future day, when prices have fallen to a more nearly normal level. The taxpayers would then get a much larger return for their money expended. The volume of demand would come at a time when it might be most welcome to fill the order sheets of mills which were nearing a shut-down, and labor would be employed which would otherwise be idle.
>
> Is it not a fact that our seasons of financial prosperity and adversity are really due to fluctuations in the tide of demand? Do we not need as much to check it in times of prosperity as to stimulate it in times of adversity? Must we not, in fact, do the one in order to do the other?
>
> We wish to emphasize the fact, moreover, that the cause which is thus indicated is really a sound financial policy. To go as the crowd goes is as contrary to good business principles as it is to the larger financial interests of the nation. Whoever at the present time erects a building, equips a manufactory, constructs a system of water supply, or does almost any piece of work which can be classed as a permanent investment will receive a smaller return for a given expenditure than at any time for many years Now is the time when all purchases and investments should be restricted to the lowest possible point. Now is the worst possible time to engage in large investments and speculations, notwithstanding the fact that every one is doing it. It is the best possible time to pay debts and not to incur them.

Iron and steel manufacturers can give ample testimony to the fact that the present advance in prices is due to buyers and not to sellers. It has not been speculative buying, or buying in anticipation of higher prices later on; for neither buyer nor seller has been so gifted in foresight as to know in advance what has taken place. We do not find that any exceptional amount of public work has been undertaken. The demand has come from so

many sources as to show plainly that it is the bursting forth of long suppressed needs. When it is considered that in the British Isles an industrial revival has been under way for three years and there is no sign of the end, there might be ground for wonder at the prevalent anxiety about the aftermath here. But it is the American pace that kills. In England prices have had a gradual rise, the greatest acceleration coming in the past year, and the dangers now faced on this side have not been accented there.

It is evident that the aversion of disaster is largely in the hands of consumers, and that the general interest would be conserved if there could be struck a better average between the fat and the lean. The suggestions of our contemporary are theoretically apropos; but as long as individual initiative is the rule in industry, we look to see the question of purchases still decided in every case by the advantage that will accrue to the buyer. When prosperity is in full swing is the time for money making, and any expenditure that will better equip the buyer to secure his share will be made. If the ascent of the market could be regulated by a mass meeting, a safer and more decorous pace would have been fixed months ago. Confidence begets confidence, just as the want of it produces its kind. Whoever is able to change this condition must be able to re-make human character and revolutionize the conditions under which the world does business.

Basic Steel Plant for Westinghouse Machine Co.

(Special Telegram.)

PITTSBURG, Pa., Oct. 11.—The stockholders of the Westinghouse Machine Co. will hold a special meeting in December to ratify the directors' recommendation to increase the outstanding indebtedness from $350,000 to $1,600,000 and provide funds for a steel casting plant and forging shop. Two 40-ton basic open-hearth furnaces are proposed. Of the product 75 to 80 tons will go into castings and the balance to the forging shop.

THE Clinton Iron & Steel Co., Pittsburg, is making a number of improvements at its Clinton furnace. A new two-pass stove, 20x92 feet, is being erected, and when this is completed it will be used to permit of the other stoves, one by one, being raised 20 feet. A simple Allis blowing engine, with steam cylinder 60x84 inches, is being added. The increased blowing and heating capacity are for the purpose of increasing the uniformity in the pressure and temperature of the blast. The Clinton iron has always had a reputation for uniformity, but these improvements are intended to further maintain this quality.

M. Winkler, of W. Sonesson & Co., Malmo, Sweden, and Copenhagen, Denmark, want to communicate with American manufacturers of wrought iron tubing, cast iron pipe, tools, shafting, wood and metal-working machinery, belting, oils, etc. He is in attendance at the trade congress in connection with the National Export Exposition at Philadelphia, this week, and may be addressed in care of the Commercial Museum.

BY an inadvertence a recent item in these columns credited the engineering contract for the Dominion Iron & Steel Co.'s new furnaces in Cape Breton to a firm other than that of Julian Kennedy. The latter has this work in hand, as was stated in the original announcement of the undertaking.

THE Pittsburg Valve & Machine Co., which now operates a plant in Allegheny City, Pa., has purchased a tract of land on Smallman st., between 27th and 28th sts., Pittsburg, and will erect an additional plant.

IT is reported in Pittsburg that the options taken on the bulk of Neville Island, in the Ohio river a short distance below Pittsburg, were secured for the Federal Steel Co., but the report cannot be confirmed.

THE National Steel Co. has leased the old Jefferson Iron Co. furnace at Steubenville, O., now being operated by the Ohio Valley Iron Co. and will come into possession Jan. 1.

HIGH BRITISH PRICES GOOD FOR MONTHS.

The British iron trade will see a level of prices substantially on the basis of to-day for months to come, according to the market review of the London *Iron and Coal Trades Review* for Sept. 29, which we reproduce below. Contracts for future deliveries now show more activity than for some weeks:

In the pig iron warrant markets this week business has been active. Prices have stiffened, otherwise transactions might have been even more extensive. For finished iron and steel there is a very strong demand, and quotations have a strong upward tendency, although no actual change has taken place. The shipbuilding and engineering industries are as busy as ever. Reports from the Continent show that trade there continues in a very satisfactory condition.

Pig Iron.—An important feature of the market this week is the inclination displayed by consumers to buy for forward as well as prompt delivery, although prices have gone up, makers showing a disposition to hold out for better rates. This implies a belief that there is no probability of any decline in prices for some months to come, and has done much to confirm the confidence of those engaged in the pig iron trade as to its future. This week Middlesbrough warrants have advanced to a point which has not been touched since the beginning of the month, and, although the difference between them and Scotch warrants is narrower than ever, large quantities of Cleveland iron ore are still going to Scotland. The shipments are satisfactory, especially with respect to deliveries to foreign ports. Hematite iron is very scarce in the Cleveland district, and a brisk business is being done at higher prices. In the Barrow district the market has shown much activity and values keep up. In Lancashire there is a stronger tone, and makers are demanding better rates for new contracts, while there is an equally buoyant feeling in South Staffordshire, where full prices prevail.

Manufactured Iron and Steel.—Finished material is in keen request everywhere, and producers are inundated with orders which they can only execute with the greatest difficulty. Prices have an upward tendency, and although there is no really quotable general rise, iron bars and hoops in Glasgow have gone up 5s. and steel hoops 10s. per ton. There is a good demand for rails, both for home and foreign consumption, and the inquiries from the United States for shipbuilding steel continue. Angles and tees are asked for, and channel bars are in very fair request. The report issued by Mr. Waterhouse to the North of England Iron and Steel Trades' Conciliation and Arbitration Board is very satisfactory. He records an aggregate rise for July-August in the prices of iron of 6s. 6d. per ton.

Comparison of Prices.

The annexed table shows the prices of Sept. 29, compared with those of the preceding week and of the corresponding period of 1898:

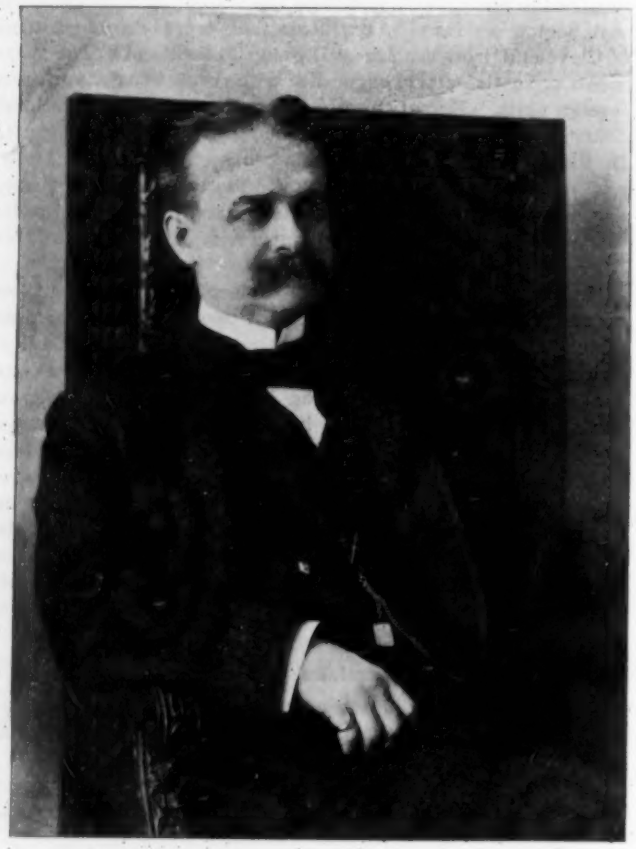
	Sept. 28, 1899.	Sept 21, 1899.	Sept. 29, 1898.
IRON ORE—	s. d.	s. d.	s. d.
Rubio, Middlesbrough	18 0	18 0	14 6
" Cardiff	16 9	16 0	13 6
Pottery Mine, North Staffordshire	14 6	14 6	13 6
Hematite, West Coast (at mines)	16 0	16 0	13 0
PIG-IRON—			
No. 3 foundry, Middlesbrough	68 3	67 9	43 3
Warrants, "	68 1	67 9	43 4½
Scotch warrants, Glasgow	69 7½	69 9	48 1½
Hematite warrants, West Coast	75 0	74 7	54 7
Cold blast (foundry), South Staffs	110 0	110 0	105 0
Welsh hematite, Cardiff	82 6	82 6	—
MANUFACTURED IRON & STEEL—	£ s. d.	£ s. d.	£ s. d.
Marked bars, South Staffordshire	9 10 0	9 10 0	7 10 0
Common bars "	8 10 0	8 10 0	6 5 0
Steel rails, Middlesbrough	6 15 0	6 15 0	4 12 6
" West Coast	6 10 0	6 10 0	4 12 6
" Cardiff	6 10 0	6 10 0	4 12 6
Steel angles (eng.), Middlesbrough	7 10 0	7 10 0	6 2 6
" " Glasgow	7 7 6	7 7 6	6 7 6
Steel plates (ship), Middlesbrough	7 15 0	7 12 6	6 5 0
" " Glasgow	8 0 0	7 15 0	6 10 0
	s. d.	s. d.	s. d.
Tinplates, Bessemer I. C. cokes, South Wales	15 6	15 3	10 3

AFTER nearly two weeks idleness, the union molders of the Lorain Foundry Co., Lorain, O., withdrew their demand for the discharge of a molder who refused to join the union, and are at work again.

ARCHER BROWN.

Resident Partner in New York of Rogers, Brown & Co.

In last week's issue we gave extracts from a review of the iron situation recently written by Archer Brown, of New York, and widely quoted in daily newspapers and trade journals. Mr. Brown is known not only for his connection with Rogers, Brown & Co., but for his comment on iron trade market conditions from week to week, and for more elaborate reviews, like the one referred to above. He was born in Central New York in 1851, and was educated at Michigan University, graduating in the literary department in 1872. He went to Cincinnati and was engaged in journalism for eight years, being five years managing editor of the Cincinnati *Daily Gazette*. In 1881 he joined W. A. Rogers in forming the firm of Rogers, Brown & Co. and the firm name still continues unchanged, but there have been added three other members, Messrs. D. B. Meacham, of Cincinnati; M. C. Armour, of Chicago; and W. C. Herron, of Cincinnati. The business began with Ohio and Southern irons, but gradually extended to other iron producing districts of the United States, but more particularly in Alabama, Virginia and the Lake regions. Mr. Rogers removed to Buffalo in 1890, be-



coming president of the Tonawanda Iron & Steel Co.; and Mr. Armour removed to Chicago in 1895, taking charge of the business of the firm in Chicago and the Northwest.

Mr. Brown removed to New York in 1895 and from that point has given general supervision to the firm's business while looking especially after the Eastern markets and the export trade and to some extent interesting himself in the organization of new enterprises. In the winter of 1897–98 he visited all the markets in Great Britain and on the Continent of Europe which were open to take American iron, laying the foundations for an export trade which has grown to quite large proportions. In the first half of this year between 300 and 400 foundries in Great Britain and the Continent were using iron shipped by Rogers, Brown & Co. The firm now has ten headquarters, Cincinnati being the clearing house for all except Chicago. The latest branch established is at Birmingham, Ala. The entire country is covered, 24 or 25 traveling salesmen being in the field most of the time. The firm's sales in 1898 were a trifle over one million tons, and in the current year had passed the million ton mark before the end of August. Rogers, Brown & Co. are more or less closely affiliated with important furnace interests both South and North, and through these touch sources of supply of raw materials and lines of transportation on the Lakes.

THE WEEK IN IRON AND STEEL STOCKS.

Denison, Prior & Co. in their weekly iron and steel letter say: "Owing to the strained situation existing in the money market the past week has been a very dull one with the iron and steel stocks. On Monday, however, under the lead of Steel & Wire common there was a marked change for the better. Steel & Wire made an advance to 53½, a little more than six points higher than its low point of last week. Federal Steel common was sympathetically affected and rose to 56, the highest point that it has seen in many days. American Hoop common touched 43½; Steel & Wire preferred, 96¾; Tin Plate common, 37⅝; and American Hoop preferred, 86, all of which quotations show that there was some tendency toward recovery. The most marked improvements in the preferred issues was that which took place in American Car & Foundry, which sold up to 63⅜, a recovery of 2⅜ points. This may be accounted for, however, by the fact that the stock will sell ex-dividend on Tuesday.

"The immediate future of the market will be governed entirely by the situation in the money market. Money has by no means settled down to its normal condition, and until it reaches that state nothing but a professional market can be looked for. The difficulties which England is experiencing in the Transvaal preclude the possibility of that country permitting the export of gold to the United States, and discount rates in London will be maintained at a figure that will make gold exports from that center an impossibility The prosperity of the country has made so many uses for money that interest rates have been greatly strengthened, and while the New York speculator is facing a stringency in the money market, the stringency does not come from hard times but from the diametrically opposed condition, abundant prosperity. Hence it is possible that stocks may advance in the face of the high rates for money. There is certainly nothing in the condition of the country to warrant a further decline, especially in the steel stocks, and the way in which they advanced on Monday is sufficient evidence of the fact that any slight let-up in the interest rate will be immediately followed by an advance in the steel portion of the list."

Fluctuations of the Week and the Year.

The following table shows the fluctuations in iron and steel stocks in the week ending with Monday, Oct. 9, and in the present year:

Name.	WEEK.				YEAR.			
	Open	High	Low	Close	High.		Low.	
Am. Car & Fdy	15¼	16⅜	15⅛	16	21⅜	May 25	15	June 15
Am. Car & Fdy pr.	61⅜	63⅜	61	63⅜	68⅜	Sept. 7	56⅜	June 16
Am. Steel & Wire..	50¼	53⅞	47⅞	53	72	May 4	45	Feb. 8
AmSteel & Wire pr	95	96⅞	93½	96¾	106¾	Mar. 13	92½	Feb. 8
Am. Steel Hoop.....	43½	43⅞	40¾	43¼	45⅝	Sept. 25	24	May 24
Am. Steel Hoop pr	85	85⅝	83½	85	86¾	Sept. 14	70	May 13
Am. Tin Plate.....	39	39	37½	37⅝	52¾	April 4	33	May 24
Am. Tin Plate pr..	86	86⅛	84	86⅛	99½	Feb 8	81	June 1
Col. Fuel & Iron...	57	57	52¼	55¼	64	Sept 11	30⅝	Feb. 8
Federal Steel.....	52⅛	56	51¼	54⅜	75	Apr. 3	46⅜	Feb. 8
Federal Steel pr....	78	78¾	76¼	78	93⅛	April 3	72½	May 13
National Steel.....	51	52¾	50	51½	63	April 24	43¾	June 2
National Steel pr..	95	96	95	96	99⅜	Aug. 11	85	May 15
Pressed Steel Car..	55	58	55	58	61	Aug. 14	44¼	June 1
PressedSteelCar pr	88	89⅜	87⅜	89½	91	Sept. 7	78	May 25
Republic Steel.....	26	27½	25⅛	27	33⅜	Sept. 26	22¼	Aug. 26
Republic Steel pr..	70	73	70	72⅞	79	Aug. 29	70	Oct. 2
Tenn. Coal & Iron	110	117	109	115	126	Sept 11	36	June 14

Banning, Cooper & Co.

On Monday, Oct. 16, Banning, Cooper & Co., Ltd., Pittsburg, will begin business as dealers in iron and steel. The firm is organized as a limited partnership association under the laws of Pennsylvania, and is composed of C. S. Guthrie, C. F. Banning and S. G. Cooper, with C. F. Banning president and S. G. Cooper secretary and treasurer. The parties have been associated with Naylor & Co., of New York, who retire from the Pittsburg district, their contracts being carried out by the new concern, which will maintain the same offices, on the eighth floor of the Lewis Block.

APPLICATION will be made Oct. 26 for a Pennsylvania charter for the United States Wire & Nail Co., which proposes to erect a plant for the manufacture of wire and wire nails at Shousetown, on the P. & L. E. R. R. below Pittsburg. Among those interested are E. B. McCrum, Jr., E. W. Palmer, L. N. DeNoon and J. C. DeNoon, all of Pittsburg. It is understood that Cleveland and Chicago parties are also interested.

RECEIVED FROM THE TRADE.

The most recent catalogue of the Kentucky Fire Brick Works, of Firebrick, Ky., and Portsmouth, O., contains a two-page view of the plant and a number of half-tones of its various products. The plant is located in a district containing 15 square miles of Kentucky flint clays, which have been found well adapted to the manufacture of refractories. Blast furnace and stove brick and cupola linings are given prominence in the pamphlet, and stress is also laid upon the company's "Kentucky Steel" brick which are designed for use in open-hearth furnaces. The statement is made that No. 1 furnace at Ensley, Ala., was in blast over four years on a Kentucky Fire Works lining.

The Cleveland Facing Mill Co., of Cleveland, Frank H. Chamberlin, proprietor, has issued a catalogue of date Sept. 1, 1899, which brings down to the present season all the lines of foundry supplies manufactured or sold by the company. Attention is called to the company's equipment for the grinding of facings and blackings and to the uniformity obtained by its practice of mechanically mixing the materials in a steam dryer after they have been ground and bolted. Among the illustrations of the catalogue is a half-tone view of seven large pipes cast for city work by a Cleveland foundry. They were 9 feet long, 11 feet in diameter, and 2½ inches thick. Cleveland Facing Mills wash was used on all the molds. A general line of lighter foundry equipment—barrows, brushes, flasks, riddles, molders' tools, etc.—is also shown. In a separate leaflet the company calls attention to its "Perfection" core box, made without dowel pins, of which many complete sets have been sold. It is made of hard wood. The catalogue will be sent on application.

The Duquesne Mfg. Co., of Pittsburg, in its 1899-1900 publication, illustrates the Simpson gas engines, of which various styles and sizes are manufactured. The chief claim of the maker is that these ranges "make gas burning an investment not an expense."

The Cleveland Crane & Car Co., Cleveland, successor to the Phœnix Iron Works Co., and crane department of the Cleveland Punch & Shear Works Co., presents in an attractive catalogue half tone views of plants in which it has installed cranes, also cuts of its Armington electric hoist. The latter have motors of dust-proof iron clad crane type. The controllers are fire-proof, with substantial contact pieces, and arranged for stopping the motor automatically, making it impossible for the load to continue in motion, should the hoist be left without the stopping of the motor. Electric traveling, belt power, hand power traveling, electric locomotive, electric jib, steam power jib, and hand power jib cranes are all illustrated. In foundry lines the company has been especially active.

Bulletin No. 7535 of the Bullock Electric Mfg. Co., of Cincinnati, is devoted to this company's direct current multipolar motors of type "N." In introducing the description of this motor the pamphlet says: "While at first the electric motor was used to drive lines of shafting from which the individual machines received their power, the latest method is to apply the motor direct to the machine to be operated. The motor which served its purpose well in driving shafting is not applicable to the more modern method. Slower speeds and more perfect machines are necessary." Several illustrations of the type "N" motors are given in connection with the description. One shows the motor direct connected to an 18-inch Le Blond lathe. In another an open motor is direct connected to a 28-inch Dietz, Schumacher & Boye lathe. A third shows the motor direct connected to a 5-ft. Niles boring mill.

A linen-bound handy volume of 370 pages, 4x6¼ inches, has been issued as Catalogue No. 11 of the J. W. Paxson Co., of Philadelphia. The publishers refer to their 40 years' experience in the manufacture and sale of foundry equipment and supplies, and add a new feature in the announcement that they will give estimates on the construction of reverberatory and annealing furnaces, open-hearth furnaces and Tropenas converters. The catalogue compresses a vast amount of information concerning foundry equipment, using numerous illustrations, including half-tone views of foundry interiors and of equipment in operation.

From the Standard Scale & Supply Co., Ltd., of Pittsburg, we have received a copy of the fifth edition of its scale catalogue. The development of this business has necessitated a number of modifications of scales, adapting them to new situations, and these late adaptations are contained in the new handbook.

The J. D. Smith Foundry Supply Co., Cincinnati, sends out in stiff-cover memorandum form the schedule of prices for the various classes of castings, as adopted some weeks ago by the Milwaukee Foundrymen's Association.

The Gobeille Pattern Co., of Cleveland, has heard much from a unique circular sent from Paris in the summer by its president, Jos. Leon Gobeille, who made his annual trip to that city to gather ideas and drawings in stove ornamentation.

The Berger Mfg. Co., of Canton, O., manufacturer of metal ceiling, sheet metal roofing and siding and kindred specialties, has brought out three unique booklets describing its "classified designs" in metal ceilings. They are entitled "A New Idea in Metal Ceilings," "Why Metal Ceilings?" and "Metal Ceilings in Churches." A copy of each will be sent to those who ask.

Catalogue No. 10 of the Northern Engineering Works, of Detroit, Mich., is devoted to cranes and air hoists. The company designs and manufactures high grade cranes, machinery and equipment. Its electric traveling crane, which is described and illustrated, is adapted to the rapid and severe service of iron and sheet mills, machine and erecting shops, and foundries. Strength, rapidity and simplicity are emphasized in the designs. A running description, with accompanying half tones, is given of three-motor electric traveling cranes, light motor crane of double girder and suspended trolley types, compressed air traveling cranes, pendant winch traveling cranes, hand chain traveling cranes, jib cranes, bracket cranes, jib air cranes and air hoists. The last named range from 4 inches to 24 inches inside diameter of cylinder, and from ½ to 20 tons lifting capacity. The company also manufactures 1-, 3- and 5-ton sizes, portable air motor geared hoists, of the chain sprocket type.

A Company Store Decision.

In the case of the State of West Virginia vs. the Mack Mfg. Co., indicted for a misdemeanor, Judge Henry C. Hervey, in the Hancock County Circuit Court, at Morgantown, W. Va., has just held the section under which the indictment was found unconstitutional. The act in question was directed against company stores, providing in substance that it would be unlawful to issue anything but lawful money of the United States in payment of wages and imposing a heavy penalty, and also making any such evidence of indebtedness a promise to pay the amount specified in lawful money. Judge Hervey takes the view that these provisions interfere with the freedom of contract between employer and employe. In summing up his elaborate opinion Judge Hervey says: "My conclusion is that the laborer has the constitutional right to sell his labor for what he thinks best, whether money or goods, just as his employer may sell coal, and any and every law that proposes to prevent him from so doing is an infringement of his constitutional privileges, and consequently void."

Railroads and $33 Rails.

The Chicago *Record* quotes "the president of one of the great railway systems" as follows: "We have not been buying any steel rails at $33 a ton, and we do not intend to pay that price for them. We are making more money than ever before, but we simply cannot afford to lay rails that cost such prices. What is more, we are not buying any bridge iron at present prices. We cannot afford to. If these prices keep up next year we will simply put off the bridge work which has been in contemplation. This is true not only of my own road, but of many others to my certain knowledge. Vast quantities of rails and bridge iron have been used this year, but not at this year's prices. That iron was contracted for when rails were $18 a ton and structural iron correspondingly lower."

C. E. Buek and associates have purchased the Stowers Mining Co.'s property at Attalla, Ala., for $100,000 and have organized the Attalla Ore Mining Co. for the development of this property on an extensive scale.

THE WESTINGHOUSE GAS ENGINE.

This engine possesses the feature of making impulses of uniform frequency for all loads, whereas in a single-cylinder "hit or miss" engine, when running under maximum load, the impulses may be as frequent as one for every two revolutions of the crank, while under light loads the impulses may be as infrequent as one to every ten to twelve revolutions of the crank. The Westinghouse engines have been built from 10 to 650 h. p., and one is now under construction which will develop about 1,500 h. p.

The more important features are shown in the accompanying engravings, which are lettered the same for each part in the three views. Referring to the cross section through the cylinder, Fig. 1, A is the shaft which carries the exhaust valve cans and it is driven by gears from the main shaft.

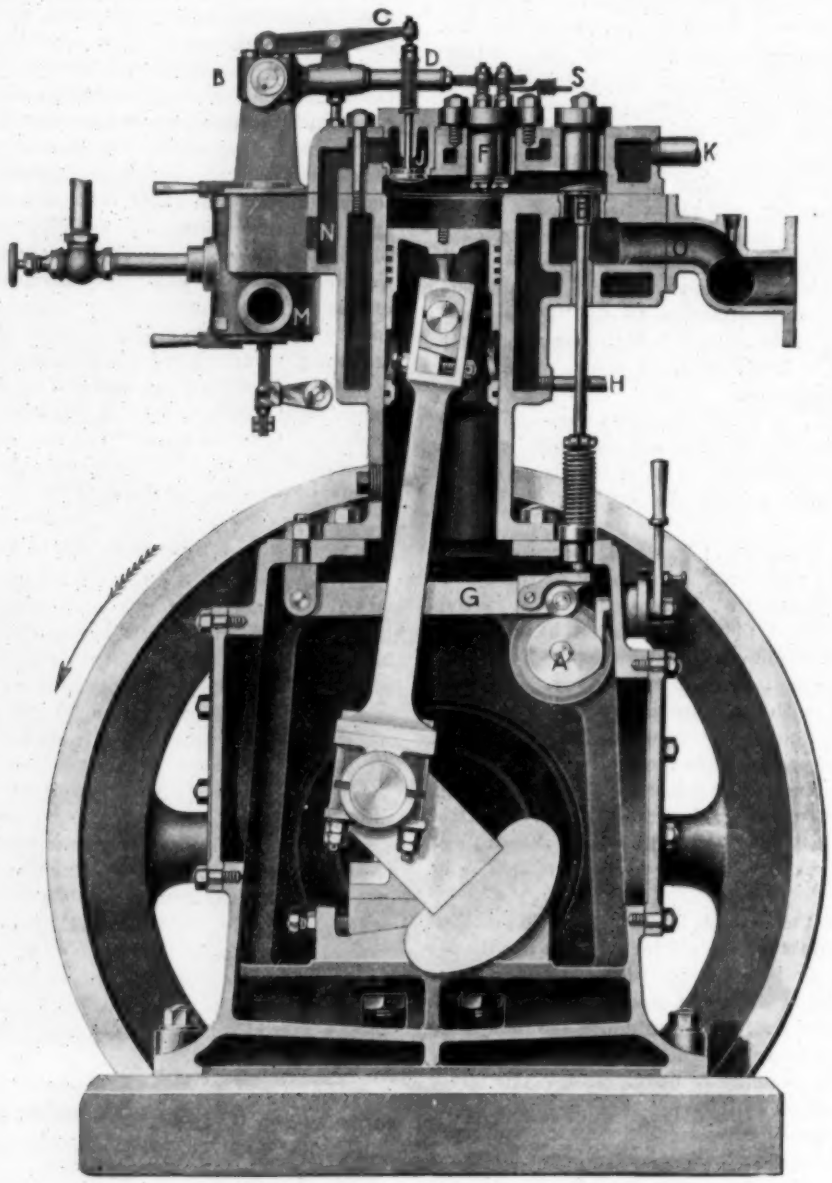


FIG. 1.—CROSS SECTION THROUGH CYLINDER OF WESTINGHOUSE GAS ENGINE

Each exhaust cam works against a roller carried on a free end of the guide lever G. The exhaust valve E has a long projecting stem and rests on the upper side of the guide lever G. The spring surrounding the stem serves to hold the exhaust valve to its seat and the stem in contact with the guide lever. From the exhaust cam shaft A a horizontal shaft with bevel gears leads to the opposite side of the engine, engaging with a vertical shaft which in turn drives the upper cam shaft B. Incidentally, the vertical shaft carries the governor. The upper cam shaft carries two cams for each cylinder. One engages against a roller on the end of the horizontal lever C. As the throw side of this cam comes uppermost, the opposite end of the lever C depresses the stem of the inlet valve J, opening the latter for the admission of the mixture of gas and air. A spring on the stem of the inlet valve furnishes a means for closing it and keeping the cam and roller always in contact with each other. Immediately adjacent to the inlet valve cam is the ignitor cam, which at the proper instant operates a horizontal plunger working through the guide D to break the electric current through the wire S at the terminals of the ignitor F.

The cylinder heads and the upper end of the cylinder are thoroughly water-jacketed; otherwise they would soon become red hot. The cooling water enters at H and is discharged at K.

The accompanying engravings show two positions of a complete cycle. The relative positions of the valves, etc., are shown separately for each part of the cycle. The reference letters are the same as in the complete section shown in Fig. 1.

The gas and air enter the mixing valve chamber M by separate inlets, in proportionate amounts which can be fixed by the attendant, and the mixture is conducted through a distributing chamber to the port N leading to the cylinder head in which the inlet valve is placed. The mixing valve is not shown in section. The following are the four steps in the complete cycle:

1. Induction.—The piston (in Fig. 2) is on its downward stroke, and the inlet valve J is open. The charge of gas and air is being drawn into the cylinder. The exhaust valve E is closed, and the inlet valve will close just as the piston reached the limit of its downward stroke.

2. Compression.—In its upward stroke, both valves are closed, and the charge of gas and air is compressed into the clearance space.

3. Ignition and Expansion.—When the piston has reached

the upward limit of its compression stroke, the crank is just passing its upper center, and both valves are still closed. Shortly before this, the ignitor cam has brought the ignitor terminals in contact, completing an electric circuit. Just at this instant it releases them, and they fly apart, actuated by a coiled spring placed in the guide D, breaking the circuit and forming a spark which ignites the charge. An immediate rise of pressure occurs, and the piston is forced downward by the expansion of the burnt gases, both valves remaining closed until just before the completion of the stroke, when the exhaust valve E opens.

4. Exhaust.—The piston in ascending, as shown in Fig. 3, forces out the spent gases through the now open exhaust valve E and the exhaust pipe O. The exhaust valve closes as the piston completes the stroke, bringing everything in readiness to repeat the cycle.

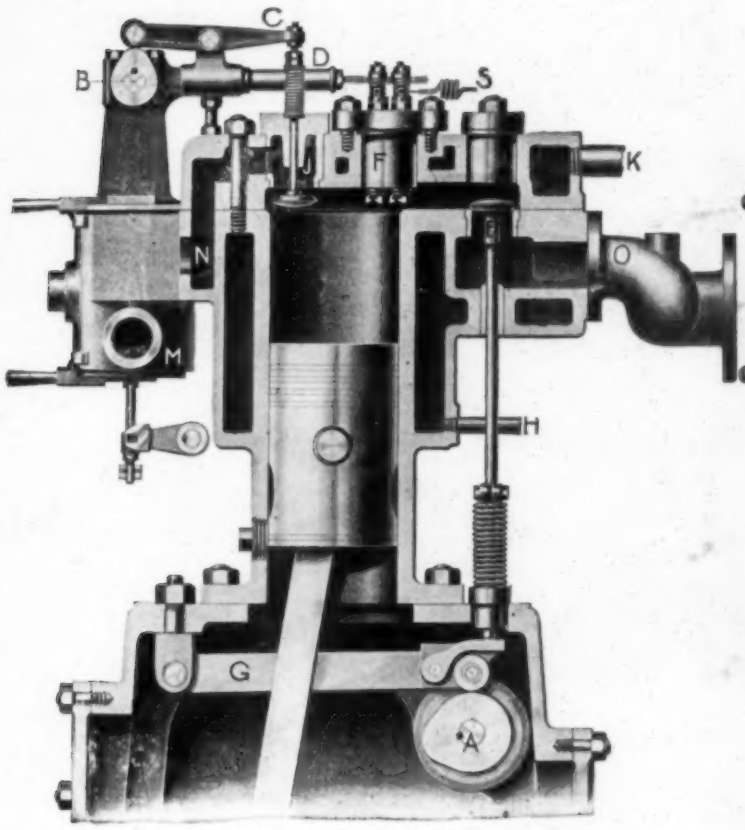
The charge of gas and air admitted to the cylinder in the "hit and miss" engines is the same in amount whatever the load may be and the impulses are consequently of uniform intensity, but are varied in frequency to allow for changes in the requirements for power. In a "hit or miss" engine when running under maximum load the impulses may be as frequent as one for every two revolutions of the crank for a single cylinder engine and one for every revolution in a double cylinder; while under light loads the impulses may not be more frequent than one to every 10 or 12 revolusions of the crank. In the Westinghouse gas engines the frequency of the impulses is the same for all loads and the relative proportions of gas and air remain constant, but the amount of the charge admitted to the cylinders and the consequent strength of the impulse is regulated exactly to the power required.

The governing apparatus is so arranged as to make it possibile to determine accurately the best proportions of air and gas to use. When the engine is running on a steady load and one mixing valve lever is moved backward and forward while the other remains stationary the regulating valve stem will be seen to move up or down as the mixture becomes less or more efficient indicating the greater or less quantities being used.

The Westinghouse automatic starter consists in the main of a small compressor driven by the engine which forces air into iron tanks, which supply is used as desired in starting. The large engines can be started as easily as the small ones. Instead of using gasoline in the cylinders the Westinghouse company makes a gasifier which supplies the gas engine with rich gas of uniform quality generated from gasoline. This gasifier is in no sense a carbureter. Any gas engine built by them can be adapted for using gasoline, while on the other hand any gasoline engine of their make can be arranged to use natural gas or illuminating gas with the best possible efficiency by simply substituting suitable pistons.

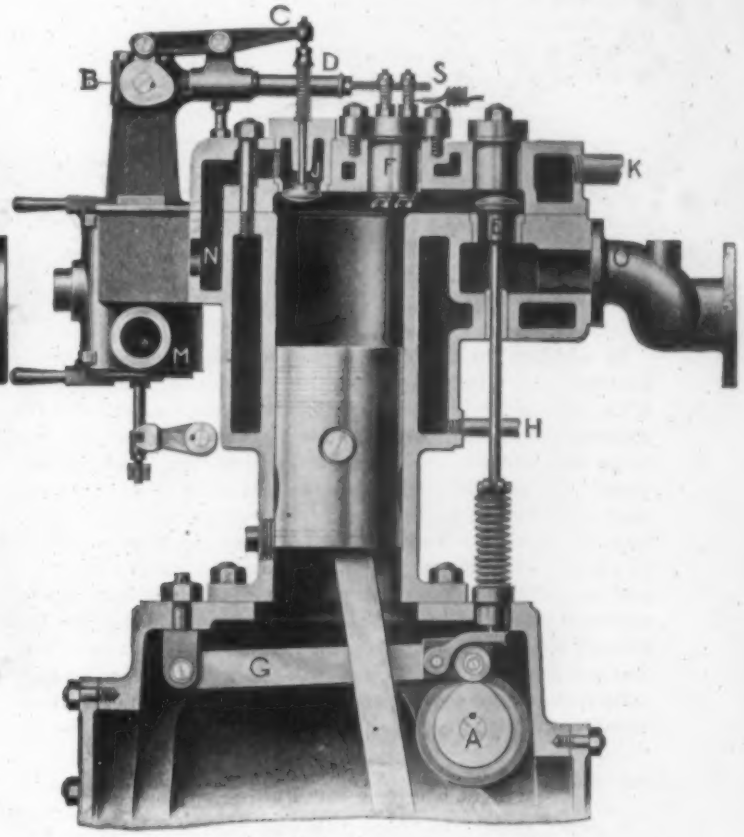
The gas consumption varies with the quality of gas used, but the company states that a fair average is from 11½ to 14 cubic feet of natural gas per brake horse power hour. This low consumption is the more remarkable when it is remembered that the gas consumption of the Lenoir engine in 1861 was about 90 cubic feet of illuminating gas. Many examples might be given of the successful running of the Westinghouse gas engine in both small and large powers, and especially where they are required to take a widely fluctuating load.

From a list of plants in which the Westinghouse gas engines have been installed we note the following as representative, indicating something of the extent of their application.



Exhaust Valve E Closed; Inlet Valve J Open.

FIG 2.—ADMISSION STROKE OF THE WESTINGHOUSE GAS ENGINE.



Inlet Valve J Closed; Exhaust Valve E Open.

FIG 3.—EXHAUST STROKE OF THE WESTINGHOUSE GAS ENGINE.

At Bay Shore, L. I., a 50-h. p. and one 85-h. p. engine have been installed. These are belted direct to the generators and the current used for electric light work. The engines are run by illuminating gas.

A good example of gas engines for street railroad work is found at Huntington, L. I., where two 50-h. p. engines are run by illuminating gas.

At Bradford, Pa., one 200-h. p. and three 125-h. p. engines are used for central station work. These are run on natural gas and replaced steam engines which received steam from boilers, the fuel for which was natural gas. In the steam plant it took 52 feet of gas to the horse power. While burning the gas directly in the engines the consumption is 13 feet per horse-power. The change was made to save the fuel expenses and also to decrease the space required for the machinery. A plant somewhat simliar is being installed at Columbus, O., where one 650-h. p. and one 280 h. p. gas engine are to be run by natural gas.

The 650-h.p. engine in the Westinghouse electrical works

takes care of sudden variations of the load, which jump from 100 to 500 amperes, and vice versa. It governs without any difficulty the most violent fluctuations of load.

As a representative example of the use of gasoline are noted the hotels under the control of the Florida East Coast hotel system, where two 50-h. p. (direct connected) and one 65-h. p. belted are now running and where seven more have been ordered, two of which will be used for exciters and five will be 85-h. p. engines driving A. C. generators. Other installations include the plant of the Riter & Conley Co., Pittsburg, which has four of 125-h. p. each, the H. K. Porter Co. and the Henry Oil Co. In the last mentioned plant a 40-h. p. engine is used for pumping oil and a somewhat similar installation is at East Pittsburg where the East Pittsburg Water Co. pumps with one of the Westinghouse 10 x 12 engines, driving an 8 x 8½ triplex, pumping 15,000 gallons of water an hour.

In addition to the data furnished above to the *Railroad Gazette*, Henry B. Longwell, of Westinghouse, Church, Kerr & Co., made a statement at the last monthly meeting of the American Society of Mechanical Engineers concerning the large size engines under construction at the Westinghouse plant. He said that from present experience it could not be said that a limit to the size of the engines would probably soon be reached. The 1,500-h. p. engine will have cylinders 34 x 60 in.; the extreme length will be 44 ft., width 12 ft. 4 in. and height 27 ft. The 650-h. p. engine which is now being used in the regular service at the works of the Westinghouse Electric & Mfg. Co. is the largest ever built. This is working successfully and takes care of wide variations of load which jump from 100 to 500 amperes, and governs these fluctuations without any difficulty.

Steam Engines for Rolling Mills.

A paper under the above title was read at the Dusseldorf convention of the German Society of Iron Smelters, by Herr C. Kiesselbach, who showed the great advantages of using compound engines for the work. Owing to the variable nature of the load, the point of cut-off must vary very greatly in single-cylinder engines; and as steam is often carried full stroke, the loss from clearance and internal condensation is often large; while if condensing engines are used the sudden discharges of high-pressure steam when working under heavy loads render it difficult to maintain a satisfactory vacuum. For these reasons, compound engines have been found the best for rolling mills. For reserve power it is advisable to use a somewhat smaller cylinder ratio than would otherwise be adopted in good practice, the value varying between the ratio of 1:2 and 1:2·3. The cut-off in the low pressure cylinder should not be set too early, or the pressure in the cylinder may occasionally back up too high. Triple expansion engines are not so well adapted as compound engines for the purpose, since the sudden changes of load occur too rapidly for a change in regulation to affect all three cylinders in time. This, says Herr Kiesselbach, is clearly shown on indicator diagrams. The cross compound engine with cranks at 90° has almost entirely been replaced in German mills by tandem compound engines, most of which are built with flywheels; but reversing engines are now being similarly constructed, and coming into general use.

AIR HAULAGE IN THE ARAGON MINE.

The Commonwealth Iron Co., C. C. Davidson superintendent, has just completed the installation of a pneumatic haulage plant at its Aragon mine, Norway, Mich. This is the first employment of compressed air as tramming power in a Lake Superior iron mine and a few data concerning it will therefore prove interesting. Iron mining men will be glad to know the cost per ton of tramming by this system, and the results attained will be awaited with interest. Four methods of tramming have been employed in Lake Superior iron mines. In the majority of cases hand power is used and this for a long time was the only system. At the Chapin mine, wire rope haulage was introduced. Later the Cleveland-Cliffs Iron Co. installed an electric haulage system, which was also adopted at the Lake Angeline mine. Animal power was introduced more recently in Vermillion and Mesabi mines, and mines on other ranges have followed them. The difficulty of getting animals down a shaft is an obstacle in some cases, and the mules selected for the work are of the smallest type.

In the discussion of the haulage question before one of the meetings of the Lake Superior Mining Institute it was the concensus that wire rope haulage is best adapted to situations in which the quality of ore is large, the distance great, and the levels straight; that the electric system could be advantageous where the quantity of ore is large, the distance great

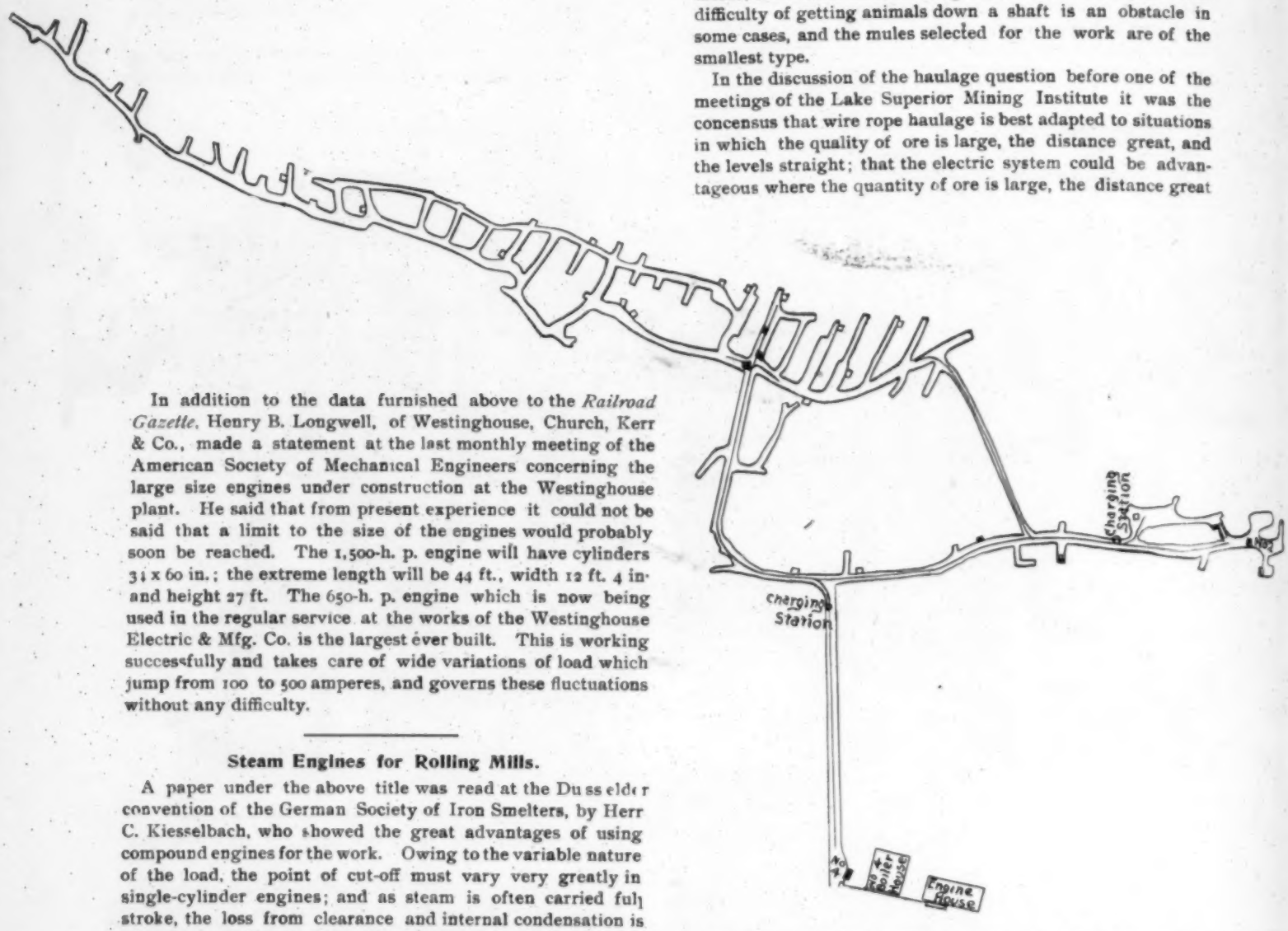


FIG. I. PLAN VIEW OF EIGHTH LEVEL OF ARAGON MINE, NORWAY, MICH., SHOWING ALSO LOCATIONS OF SHAFTS AND SURFACE LOCATION OF POWER HOUSE.

and the levels tortuous, branches being necessary to reach outlying portions of ore. But where the quality per level is smaller, the distance not quite so great, and flexibility in operations necessary, animal power could well be employed. Where the quantity of ore is smaller and the distance still less, hand tramming would probably be most advantageous.

At the Aragon mine the pneumatic system just installed is to take the place of mules. The new plant was furnished by the H. K. Porter Co., of Pittsburg, and consists of a Norwalk three stage air compressor having a steam cylinder 14 inches in diameter by 16-inch stroke, with air cylinders 10½, 7¾, and 2⅝ inches in diameter. This compressor, at normal speed, will compress 125 cubic feet of free air per minute to 800 pounds. The compressor is connected to two storage tanks located immediately outside of the engine room, and the air

is carried from these tanks in a 3-inch pipe to the collar of one of the shafts, thence down 750 feet, to the eighth level of the mine, and through drifts to another shaft, near which another storage tank is placed. The total length of the 3-inch pipe is about 1,800 feet, and the size of each of the storage tanks is 3x17 feet. Two charging stations are placed in the mine at convenient points, and a round trip wth a full train of cars will be made with one charge of air. The shortest haul for the round trip is about 1,200 feet, and the longest about 4,000 feet.

The locomotive weighs about seven tons, is 5 feet 2 inches above the rails, 4 feet 2 inches wide, and 13 feet long over bumpers. It has four driving wheels 24 inches in diameter with a wheel base of 4 feet. The gauge of the track is 22½ inches. The cylinders are 7x12 inches. The air pressure in the storage tank is 800 pounds, and in the locomotive tank 700 pounds. This pressure is reduced to the regular working pressure of 140 pounds. The time required to charge the locomotive tank is from 30 to 60 seconds.

The haulage plant is capable of handling 1,000 tons in 10 hours. The trains are made up of 20 cars each, and four trains can be taken every 10 hours from each of the ten places from which ore is gathered. Three of these places which are near the No. 2 shaft, shown in Fig. 1, send their ore to that shaft. The other seven places are in the more remote portions of the eighth level and their ore is sent to the No. 4 shaft. Twenty empty cars and the motor weigh 18 tons; 20 loaded cars and the motor weigh 43 tons. Fig. 2 is a view of the Porter locomotive "Sarita" which was built for the Aragon plant.

FIG. 2.—COMPRESSED AIR LOCOMOTIVE FOR THE ARAGON MINE, NORWAY, MICH.

Rising Values of British Iron Properties.

One of the most interesting features of the present revival of trade is the improvement that has taken place in the market value of the shares of the iron and steel companies. This has been conspicuously the case with some of the leading Scotch concerns. The Calderbank Co.'s shares, which could not find a market at any price a few months ago, are now a valuable asset. The Steel Company of Scotland's shares less than four years ago were quoted as low as 15s., whereas they are now quoted at £8¼, and the company is this year paying a 6 per cent dividend. Most of the other iron making concerns, except a few on the West Coast, are quoted above par. The Barrow Co. and the Millom & Askam Co. remain in an exceptional position, which may be taken as an evidence that investors have not much faith in the future of the district in which these concerns are located. On the other hand, the Moss Bay Co.'s shares have advanced from ½ to 3⅜, and the outlook of this company is regarded as not at all favorable. The most notable example of appreciation is that furnished by the Consett Iron Co., whose shares are now about 36, or early five times their par value.—[London Iron and Coal Trades Review.

PRESIDENT GARY ON THE SITUATION.

The following New York interview with Judge E. H. Gary president of the Federal Steel Co., concerning conditions in the iron market from the standpoint of his company is interesting. As to next year's ore and the margin between ore supply and demand he is probably misquoted:

"While prices of rails have been advancing for several months a large quantity were sold at the low prices prevailing in the fall of 1898, and for some time previously, say $18 to $19 per ton. I estimate that in round numbers about 1,600,000 to 1,700,000 tons of rails were sold around those figures, while about 350,000 to 400,000 tons have been sold at the higher prices. The latter have not yet been delivered. Of those placed at last year's prices about a million and a quarter tons have been manufactured and delivered, leaving from 300,000 to 400,000 tons of which delivery has not yet been completed. In nearly every other line the manufacture of goods sold at the lower prices of last season had been completed by July 1, or sooner, so that in these goods the work now being done is at higher figures.

"As to the future of prices I think that pig iron is going to be scarce, and that it will advance further. I wish that there might not be any further advances. I believe that $20 for pig iron is high enough. But new ore will not come down from Lake Superior until next June, and there will not be surplus over manufacturers' needs between now and the middle of next July of over 50,000 tons. There is consequently no indication of any sudden change in prices or of any change in the near future, except to a higher level. As an instance of the condition of the market I can mention that I recently bought 63,000 tons of pig iron on which another party had had an option, though I was not aware of this at the time. The option expired at three o'clock in the afternoon of a given day. Application was made by the other bidder for an extension until the next morning, but my offer was on file and I secured the iron. Another item which may be of interest is that the Federal Steel Co. has recently sold plates for delivery throughout 1900 at $56 per ton."

Judge Gary added that from one-third to one half the Federal Steel Co.'s output was in rails. The company also manufactures large quantities of billets, plates, rods, merchant steel, frogs, switches and electric motors, the latter being made at the Johnstown plant. The total tonnage of the company, he said, was fully 2,000,000 tons of finished product. The company mines about 3,500,000 tons of ore annually and carries on its Duluth & Iron Range Railroad about 4,500,000 tons annually. The company will make next year, Judge Gary said, about 1,800,000 tons of coke, all of which and more it will use for its own purpose.

The repairs being made in the Iron & Steel Furnace at Ironton, O., controlled by E. L. Harper of New York and others, are nearing completion.

SEVENTY-FIVE YEARS' PROGRESS IN MINING AND METALLURGY.*

BY CHARLES KIRCHHOFF.

It is with swelling pride that we may pause to look over the achievements in mining and metallurgy during the past 75 years. Within that brief span, which as we reckon generations, has extended over only two and a half, there has been created our great industries of today. Our country may look back over what has been accomplished with satisfaction, even if we admit frankly and fully that we have been blessed with extraordinary resources. It may seem almost crude to gloat over mere arrays of figures, and the reproach, occasionally made, that we worship quantity unduly, has some justification, yet the record is an amazing one, nevertheless. A more serious criticism is that we have been prodigal of our heritage. Let it be admitted that we have been, and are even still, in some respects wasteful and extravagant. Much of that reproach vanishes, however, when the conditions are taken into account. In the arts, in engineering and in manufacturing, after all, it is the balance sheet which rules, and from an economic point of view, waste may be not alone justified, but be actually imperative.

It is difficult to measure progress, qualitatively, in such branches as mining and metallurgy. It is expressed in the more complete utilization of the natural resources, as in the increase in the total extraction of the contents of a coal bed. It is in evidence in the form of a capacity to utilize bodies of ores, lower and lower in grade. It is proven by ability to produce from rebellious, or impure ores, metals nearly chemically pure, and commercially available for a wider and wider range of consumption. It finds expression in the disappearance of supremacy of the brand, only too often the creatue of fortuitous circumstances. It is measured by an expansion of markets which may be due to the fact that technical progress has proceeded more rapidly in one country than in others. For these reasons a simple enumeration of statistics of production only partially reflects the development of an industry. Yet that in itself shows a record of which we well may be proud.

Practically 75 years ago our greatest mining and metallurgical industries were in their infancy, and many were not even started. We had only begun to mine small quantities of anthracite coal. We were producing iron, but had at an earlier date been relatively more important as an iron manufacturing nation. Silver, copper and lead were made in irregular, very small quantities. Zinc was not produced, and the gold output—with the Georgia gold rush of 1828-1830—was about to begin. In other words, our mining and metallurgical industries were of so limited a character, that compared with the ancient operations of the leading European nations, they were insignificant to a degree.

While it is true that our miners and smelters arose to the occasion when they were called upon to meet special conditions, the general fact is apparent from a study of our development that we first copied and then adapted, the methods approved by experience in Europe. We were forced and did create hydraulic mining to collect the gold from alluvial deposits. We developed the preparation of anthracite for the market. We had nothing to guide us in handling the copper rock of Lake Superior. The Washoe process was worked out to treat the silver ores of the Comstock lode. There were a few precedents for methods in the petrolium industry, and we had to learn by ourselves how to collect, distribute and utilize natural gas. But Cornish, Welsh and English miners long controlled the working out of our mining methods. German and English metallurgists guided our first steps in beneficiating our more complex silver, lead and copper ores.

One of the most brilliant reports on the state of the art ever written, that of Abram S. Hewitt on the Paris Exposition of 1867, is a confession of superiority of European methods in iron manufacture which is almost staggering to one who reads it in the light of the present day. I cannot help feeling that the recognition of our indebtedness to European practice in the earlier days should be insisted upon, since it is becoming altogether too common to assume that we are the chosen people so far as the mechanic arts are concerned. Many of you have undoubtedly, like myself, encountered that feeling in such places that the fear of the danger of overconfidence is naturally aroused.

A striking fact is the growing interdependence of the various branches of the mechanic arts, as contrasted with the conditions prevailing 75 years ago. The one relies upon the other, not alone for its products, but is aided too by suggestions and support. The metallurgist's progress is accelerated by the mechanical engineer, and the latter looks to the former for increasingly strong and reliable materials. The electrician has greatly widened the capacity for improving methods on the part of the copper producer, and in turn is under a debt to him. The cheapening of fuel, due to the efforts of the coal miner, and the achievements of the rail-maker, are returned in kind by the railroad builder, who has taught both much of value in transporting materials. Thus, all are shoulder to shoulder, in the march of progress, mutually helpful, and united, all-powerful.

To a constantly increasing degree pure science, primarily in search of the truth for its own sake, sheds its searchlight along the path, and has become a closer and more valued ally, year by year. Many of us will recall how the majority of active workers looked askance at this meddler, preferring to allow their own fancy full sway whenever they stopped to seek for causes or explanations. We may sometimes become impatient when the laborious and apparently hyper-critical methods of the scientist do not more promptly clear an obscure point, or furnish us with a suggestion for successful new lines of work, but the day has long passed when we treated research with grudging respect, if not with open hostility. No one is now readier to acknowledge his indebtedness to the chemist or the physicist than the manager or the practicing engineer. The fear is disappearing of impracticable science on the one hand, and of unscientific practice on the other. And foremost in the work of harmonizing both in this country has been the time-honored body whom you, Mr. President, represent. The splendid array of the volumes of the transactions of this Institute is in itself the greatest monument to the man whose name it bears, and to those who have labored in pursuing in his spirit the promotion of science and the arts as a means toward promoting the happiness of mankind.

Mining.

With the widespread search all over the world, and the increasing number of trained observers, there has been an enormous accumulation of observations and data relative to mineral deposits. In the case of bedded deposits, the relations between mining development and economic geology have become closer and closer. But on the whole it cannot be said that this branch of science has given much direct aid to the metal miner. The systems of extraction have not undergone any radical improvement. On the whole, they are modified more frequently to meet more closely local conditions. It is rather in the work of excavation proper that progress has been most striking. It was J. J. Couch, a Philadelphian, who, in 1849, patented the first percussion drill ever made. Herman Haupt experimented with rock drills at the Hoosac Tunnel from 1856 to 1861, while the first drill tried in mining was that of Schumann at Freiberg, in 1857.

Colladon had proposed to use compressed air to work drills as early as 1852, but general attention to rock drills driven by compressed air was attracted by their employment at the Mont Cenis tunnel in 1861, the plan to adopt them having been approved in 1857 as the result of Sommeiller's work. Quickly following upon the start thus made by power drills, came the introduction of high explosives. Nobel first applied nitroglycerine in 1863, and its use was begun in 1866 at the Hoosac tunnel. A year later Nobel introduced dynamite, and since then powerdrills and high explosives have wrought a complete revolution in mining, by increasing the speed of development and extraction, by very greatly increasing the efficiency per man employed underground, and by heavily reducing the cost. By constant improvement in design and detail of both compressor and drill, machines have been created which have a wonderful life and efficiency, considering the adverse conditions under which they are expected to operate. What the defects in design in the early

* An address delivered at the Mining and Metallurgical Section meeting in celebration of the 75th anniversary of the founding of Franklin Institute, Philadelphia, October 4, 1899.

days meant is illustrated by the fact that in 1864 in the Mont Cenis tunnel it took an equipment of 70 Sommeiller drills to keep eight steadily at work, and in 1867 200 were needed to maintain 16 in actual operation.

The mechanical engineer and machine builder have given their powerful aid, too, in improving pumping and hoisting machinery. The simple and effective American direct acting pump has done valuable service to mining, although for heavy service and large quantities of water it is giving way to more elaborate engines. In hoisting appliances, for deep mining we long remained behind European practice, our shallow mining not calling for heavy engines. During the last decades, however, some splendid equipment in magnitude, in speed and in economy of operation has been designed in this country, some of the greatest of these engines having been built in this city.

Underground traction has undergone far reaching changes. Wire rope haulage was introduced into colleries long before San Francisco led in surface cable traction, and in this country pneumatic and electric haulage was very promptly adopted and very rapidly developed. These, however, are only recent achievements, progress in under ground haulage having been very slow for decades. In timbering the Comstock square set was a characteristically American creation to meet exceptional conditions, and it is true that the preparation of mine timbers above ground by machinery was first practiced in this country.

For a long time, the concentration of ores was neglected, simply because in many remote sections in the Unted States it did not pay to turn to mechanical dressing and because the oxidized surface ores, easily smelted, did not offer opportunities. An exception must be made of the Lake Superior copper region. There the Ball steam stamp quickly superseded the time-honored battery. Subsequently, Leavitt reduced the steam consumption by compounding, and more recent practice has proven that the spring foundation is not equal to the solid anvil in bringing out the highest efficiency. Ore concentration has been well developed in later years in Southeast Missouri and the low grade lead and copper camps of Colorado, Utah, Idaho and Montana.

It would be a serious oversight, in dealing with the treatment of ores, to overlook the enormous influence which the introduction of the Blake crusher has wielded in the efficient handling of rock. Nor should later types of crushers, like the Gates, be overlooked. An example of steady progress in crushing apparatus is furnished also by what is known as the California stamp mill. Every detail has been watched and worked out for decades and a number of efficient self-feeding appliances have been added, until today there are enormous plants pounding away year in, year out, without any intermission, with merely a crew of inspection to represent the labor account.

It seems certain that the part which the rock drill has played in general mining is destined to be paralleled in coal mining by the modern coal cutting machinery. The difficulties inherent in handling mechanical apparatus in low rooms may account for the fact that progress has apparently lingered so far behind in this field. In Europe, as well as in this country, inventors took hold of the problem in the fifties, but little headway was made for many years. It is only quite recently that machinery for this purpose is being introduced with a rush. Among the pioneers were Harrison with a pick machine, and Lechner with a cutter bar machine. All the earlier types were driven with compressed air, and it was not until 1889 that electricity was applied to the Jeffrey cutter bar machine, since superseded by the electrically driven chain breast machine. How rapid has been the development of this branch of this work in this country in recent years is shown by statistics compiled by E. W. Parker, of the United States Geological Survey. In 1891 6,211,732 tons of coal were mined by machines represnting 6 66 per cent of the whole. In 1898, the tonnage had jumped to 32,413,144 tons, or 20.4 per cent of the whole. It is not too much to say that from an economic point of view, this is the most far-reaching and significant recent development in mining.

A splendid achievement in mining was that of handling auriferous sands by hydraulicking. I do not remember ever having noted in our literature any definite data which might fix the credit for this upon any one man or group of men. The date is placed at about 1853, and in those stirring times so soon following the discovery of gold in California, probably no record was left. The further stages of its development are coupled with the names of a number of inventors of nozzles and many ingenious hydro-dynamic and hydro-static contrivances and in its greater days, before the anti-debris laws in 1862 cut off the work, bold and splendid engineering work was done in connection with these undertakings.

In more recent times some very thorough work has been done in one branch of ore dressing, and that is, in magnetic separation of iron ores. A number of American inventors, among them Ball & Norton, Pierce, and last and not least, Edison, have labored to utilize the lower grades of magnetites in the Eastern states. The problem of cheap and effective crushing involved has been carefully studied and brought out new ideas, but economic conditions for awhile pushed the whole undertaking into the background. Recent events point to fresh opportunities in this direction.

Metallurgy.

Gold.—In the metallurgy of the precious metals, marked progress has been made, although no really revolutionary methods have come to the front until the present decade brought the cyanide process. In gold extraction the improvement in the California stamp mill, largely mechanical, has already been alluded to. There have been added, in the amalgamation process, some ingenious contrivances, but it was not until the experienced chemist drove out the horde of so-called "professors" and charlatans that the treatment of auriferous concentrates and pyrites was a success. The chlorination process, together with the improvement and design in operation of the batteries, and the introduction of the Frue vanner and machines of its type, has rendered possible the profitable treatment of very low grade ores. These are today prosperous enterprises based on a yield of one-tenth of an ounce of the yellow metal to the ton of rock—a quantity so minute that no gold is visible in the ore, week in, week out.

The chemist again has intervened in recent years. While the solvent power of cyanides on gold was known early in this century, it was not until the later eighties that the McArthur-Forrest process made that method practicable by utilizing the fact that the zinc shavings may be used as precipitent.

For the treatment of more complex ores there was developed relatively early at the Argo Works in Denver a series of methods dependent upon the employment of copper as a carrier, and more recently pyritic smelting is gaining ground. It is based upon the treatment of sulphide ores in the blast furnaces so that a considerable part of the heat produced by their oxidation is utilized in their fusion. Small quantities of lead or copper serve as collectors of precious metals.

Silver.—Although the patio process of amalgamation was invented in 1557 by Bartolome de Medina at Pachuca, followed in 1590 by the cazo process of amalgamation invented by Alonzo Barba at Potosi, no real improvement followed in the succeeding centuries. On the heels of the discovery of the Comstock lode in 1859 by O'Reilly and McLaughlin, came the invention of what is known as the Washoe process of amalgamation by Almarin B. Paul and James Smith. On the oxidized and chloride ores of the surface it did admirable work, but as the more rebellious material below drainage lever appeared in growing quantities, auxiliary operations required growing attention, the Augustin, Ziervogel and Patera processes brought out from 1843 to 1858 in Europe having been used only locally here. It was in the direction of improving the chloridizing roasting that metallurgists sought and found a solution of their troubles. Brueckner, Stetefeldt, Howell, O'Hara and others did admirable work, but with the steady improvements in lead smelting, increasing quantities of the rebellious silver ores were diverted from the amalgamating mills to the smelters, and now silver milling has shrunken to a secondary place.

Lead.—Although lead mining was begun as early as in the days of Law's famous Mississippi company, and Mine La Motte in southwest Missouri, still in active operation, was discovered in that time, still production did not develop seriously until late in the twenties. It attained about 10,000 tons per annum in 1833. With the rich and pure ores the Scotch hearth served admirably and remained the standard method until the discoveries in quick succession of the rich

ore bodies of Eureka, Nevada, and of different camps in Utah, late in the sixties, led to the copying of German blast furnace practice. Arents, Eilers, Hahn, Grant and others soon introduced improvements, Arents' siphon taps being a very important step forward. Water jackets appeared and a thorough scientific study of the chemical composition of slags led to more regular and cleaner working, and the collection of flue dust assumed growing importance, Iles, of Denver, doing conspicuous work in this direction. Charcoal as a fuel gave way to coke—the quantity of lead in the smelting charges needed to cover the precious metals was steadily crowded down under the pressure of a scant supply of lead-bearing ores. With the steady development of the railroad system of the Rocky Mountains, dry ores carrying little or no lead became available in larger quantities, and today American lead smelting plants are models for the world.

As an incident of progress in another direction may be mentioned the Bartlett process for the direct production of white oxide for paint in successful operation at Joplin and at Canon City.

In lead desilverizing and refining, a modification of the Pattinson process, invented in 1833, found only a passing application. Soon after the argentiferous base bullion of the Rocky Mountains made their appearance the Parke's zinc process invented in 1852, was first introduced at the Balback works at Newark, and the most important improvement in it was that of the Faber du Faur furnace for distilling the rich zinc alloy. Since then progress has taken the direction of economic handling of large charges and the introduction of labor-saving appliances.

Copper.—Although some copper was mined along the Atlantic coast at a number of points in the eighteenth, and during the earlier part of the present century, it was not until the gradual opening up of the Lake Superior region from 1845 onward that it attained the dignity of an important industry. Curiously enough it was in the same year that the smelting industry on the seaboard was started by the Revere Copper Co. and the Baltimore and Cuba Smelting and Refining Co., both depended almost entirely upon foreign supplies of raw material. These flourished for about 20 years, and then collapsed, or lead a precarious existence until domestic supplies of furnace material from the Rocky Mountain region caused their revival. Today our tidewater plants are among the great works of the world and have begun to again draw heavily from foreign sources. Thus Australian black copper comes to us via London for treatment, to be returned to the European markets, and Chili bars are making the same journeys. Metallurgically, there is little to remark concerning the development in the treatment of the native copper of the lake region which has held sway in the market for so many decades. The time-honored methods of refining continued with little change, although effort was made to introduce the Siemens open-hearth furnace.

A new era began with the opening up of the oxidized deposits of Arizona and the ores of the Butte district. In the former the water jacketing of the furnaces was one of the first successful steps, and a general improvement of practice followed quickly. In the Butte district a great deal of tentative work was done in concentration, in roasting and in smelting in reverbatories and in shaft furnaces. The Brueckner, Brown and Wethey roasting furnaces were adopted and it was only in 1893 that the Manhes process of Bessemerizing, invented in 1883, in France, was first introduced. The practice has been improved very rapidly, and now the remelting of the matter is being superseded by direct transfer from the furnace to the converter. Almost simultaneously came the electrolytic process of separating the precious metals, in which very rapid progress has been made and which, coulped with the Bessemerizing, an economic revolution has been effected, not alone in cost of production, but also in the direction of furnishing a high grade metal from impure ores.

Iron and Steel.—And now we approach the greatest of all metals, iron, in the development ot which this state has had so conspicuous a share. It would be presumptuous in me to even sketch its course, who have been a mere onlooker during the past 25 years, when there is with us one who has lived hrough its most glorious period and has had so commanding and conspicuous a part in the great deeds of American iron makers and engineers. [Referring to Mr. John Fritz, whose address was on "The Development of Iron Manufacture During the Past Seventy-five Years."] After all it was not until the days when John Fritz became a leader that the marvelous development was initiated. Remember that it was not until 1839 that anthracite was used in the blast furnace and that six years later raw bituminous coal was tried in this country as a furnace fuel. You must recall that boiling was only introduced in 1848, that our modern steel making processes did not really occupy a commanding position until late in the sixties, and you will realize that the great period of the iron industry is really concentrated in the last 30 years.

One fact perhaps you will allow me to dwell upon, and that is, that the Bessemer process really forced a recognition of scientific work upon the attention of the practical iron master. The chemist very soon became a part of the force of the steel works and somewhat later of the furnace plants who were anxious to have them as customers for pig iron. Not that chemical research had not long since been directed to metallurgical operations, and not that a few did not indulge in speculations as to the scientific causes of observed phenomena.

It was only lately that I came upon striking evidence of that in David Mushet's classical work on "Iron and Steel" printed in 1840. The following passage is characteristic: "The quality of air during the summer months becomes much contaminated from combustion, by holding in solution a much greater quanitiy of moisture, the abundance of nitrous particles may also diminish the usual proportion of oxygen. This will account for the inferior effects of combustion, both in common fires and in the blast furnace. It will also in a measure tend to solve the curious phenomenon of pig iron taking up less carbon in summer, although reduced with a superior quantity of fuel. The air discharged most probably contains ess oxygen, yet the metal is much less carbonated than at other times when contrary proportions exist. Most probably the deficient carbon is carried off by dissolving in hydrogen, forming a constant stream of hydrocarbon gas, while the oxygn that is free unites to the iron, and while it reduces the quality at the same time the quantity is reduced by a portion of the metal being lost in the scoria."

It is thus that one of our pioneer metallurgists seeks an explanation for the fact that furnaces are apt to make off grade irons in summer—a phenomenon which is said to have become a marked one in this boom year 1899.

Recent history in the branches of the mechanic arts records many instances of the powerful aid which theoretical investigation has offered to them. One of the most conspicuous was von Ehrenwerth's heat calculations in connection with the basic Bessemer process which established the role which phosphorus is capable of playing as a substitute for silicon as a heat agent. Nor should that promising field be overlooked which microscopic investigation hold out. Possibly in that respect 20 years hence our groping may appear not unlike that which Mushet's appears to us now.

But progress during the last 75 years has been pushed along lines as important in their way, as the cheapening of product, or the raising of the standard of quality. Like in other dustries, the captains of ours have displayed increasing care of their armies of men. It has become an axiom with every enlightened manager that every means which shall render more satisfactory the surroundings of the workers is bound to tell upon the results of their labor. Compare our modern plants with those of former decades, of which some even survive now, and note what attention is paid to make the conditions under which manual labor is performed as tolerable as the circumstances will permit. There has been a tremendous improvement in this direction, and it does not lessen the achievement when we frankly acknowledge that it is largely due to the recognition of the fact that progress in this direction pays handsomely.

Let me go a step further, and that is, that the crowning glory of the efforts to improve our mining and metallurgical industries has been that they have contributed their full share to the development of this materialistic age. They have helped to bring within the reach of an ever-growing circle of people not alone the necessities, but also many of the comforts, and some of the luxuries of life. Let me confess that it seems to me the greatest and most commendable of achievements to raise ever so little the mass of humanity in

civilization, and that is what progress in the mechanic arts during the past century has accomplished in a striking manner. Start the masses on a higher plane, level them up. The great genious may not tower so far above them as once he did, but that is again in harmony with our democratic institutions. Let there be an increasing equality of opportunity, even though it makes the struggle fiercer and fiercer, if only public conscience will demand with sterner emphasis that the means for achievement be fair.

It was the keynote of Franklin's life that all his thoughts and all his endeavors were directed to making his work of benefit to the human race. Although those who have labored in our field may not have done so as consciously or as deliberately as he, the fact is that progress in mining and metallurgy has powerfully contributed toward that end.

RAPID ANNEALING OF BLACK PLATES.

Some newspaper comment has been given to an invention recently patented by Wheeling parties, which is referred to in the review of patents in another column, on a new arrangement for annealing and pickling black plates. The patent covers an annealing furnace, pickling bath, water bath, and drying oven, in line, with an endless conveyor extending through and returning underneath, through a "cooling trough." The idea is to place the plates one by one on the conveyor, which has gripping mechanism, and thus pass them successively through the annealing furnace, the pickling bath, the water bath and finally a drying oven. The annealing and pickling thus given are, of course, the first annealing and pickling, the order of which, it will be noticed, is reversed. The only advantage which can be claimed is the reduction in the amount of handling required, which would be an item, and the reduction in the time of annealing. This latter would be of no consequence, as the total tonnage of plates handled by such a furnace in a given time could scarcely exceed that of the ordinary furnace, which handles so many more plates at a charge as to balance the length of time they are in the furnace. The oxidation would be extreme, as is evidenced by the effect which a small crack in an annealing box produces on the contents. This would entail an increased loss of iron, and the cost of acid to remove the oxide would be increased in still greater ratio.

There is great room for improvement in tin plate manufacture, but the present outlook is that the true development will come, not from a change in the fundamental processes, but in improvements by which these same processes can be worked with less cost. Thus the present pickling method, by a rather violent up-and-down motion in the acid bath, is likely to be retained, but a less laborious method of packing the plates ready for the pickler is in order. On the same principle, the old method of annealing the plates in boxes has been retained, but great improvements have been made in the handling of the boxes. In the cold rolling department, the old system of cold rolling is retained, but by mechanical means the work of feeding the plates through the rolls has been much reduced. The development of the future is likely to be in the same direction; the old processes will be retained, but they will be practiced in a much more economical manner. The cost of tin plate making is not nearly so much in the processes themselves, as in the labor connected with them, nor has it been conclusively shown that any of the regular processes can be dispensed with or greatly modified.—[Tin and Terne.

Melting Steel or Wrought Iron Turnings.

A writer in the *Foundry*, in reply to an inquiry says: "Your correspondent who asks how to melt steel or wrought iron turnings, will find the best plan is to put them into the crane ladle, in the proportion of from 12 to 20 per cent of the capacity of the ladle and then tapping good hot iron upon them. By this method he will avoid bunging the cupola, and will lose none of his metal by evaporation, as he would be likely to do if he melted wrought iron turnings in the cupola. Where I learned my trade, steel turnings were always used in this way to cast hammers and blocks for the forge. These blocks as they wore out were melted in a reverbatory furnace and cast into pigs; the pigs being afterwards used with about 30 per cent of Scotch pig to cast cylinders and other castings requiring the best quality of iron."

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our Advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

The Michigan Machine Co., Kalamazoo, has filed articles of incorporation; $5,000.

W. R. Smith and William Hook, of Union City, Ind., are investigating with a view of establishing an iron foundry in Joplin, Mo.

The South Bend Foundry Co., South Bend, Ind., has been incorporated. Capital stock, $10,000.

F. E. Church Co., Agan Bldg., Cambridge, N. Y., is in the market for a five horse-power gas or oil engine.

Prof. F. E. Daniels, St. John's College, Annapolis, Md., will purchase a complete set of castings for a steam or gas engine from one to three horse-power (gas engine preferred).

James & Co., Chattanooga, Tenn., are in the market for two hoisting engines, 30 to 40 horse-power; also second-hand air compressor.

New Construction:—

The Central Foundry Co., 100 Broadway, New York, contemplates building a large pipe works in the Birmingham, Pa., district, and President Gerard Schumaker has been investigating possible sites.

J. P. Dietz will erect a large machine tool works in Cincinnati, to build lathes and other tools.

The Virginia Southwestern Railway Co. has awarded contract to the Structural Iron Co., of Baltimore, Md., for a foundry 500 x 100 feet.

The Malleable Steel Range Mfg. Co. South Bend, Ind., which manufactures 72 styles and sizes of family ranges, is preparing to enlarge its plant.

Joseph Wharton is to build a new blast furnace at Port Oram, N. J. Two horizontal blowing engines have just been ordered from the Southwark Foundry & Machine Co., of Philadelphia. A casting machine is to be adopted for both the present and the new furnace.

The Metal Wheel Co., of Havana, Ill., will erect a brick addition to its plant 60x200 feet, 14-ft. ceiling, for the exclusive purpose of manufacturing shovels. The structure will cost $25,000, and will employ about 50 men.

The Rome Steel Co., Rome, N. Y., has been incorporated and will erect a plant to manufacture rods and angles for the use of the Rome Metallic Bedstead Co.

Plans are in the hands of contractors for four buildings for the Beaver Roll Works, Bridgewater, Pa., which will occupy a strip of land along the Ohio River at Bridgewater.

The Joseph Dixon Crucible Co., Jersey City, will proceed at once with a three-story addition, 185x 40 feet. This with another small addition are depended upon to put the company abreast of its orders. At present its plants are overflowing with business.

The United States Wire & Nail Co. will apply for a charter Oct. 20. The capital stock has been increased to $100,000. The works is now building at Shousetown, Pa.

The J. I. Case Plow Works, of Racine, Wis., has let the contract to erect a three-story brick addition to the polishing room, 60 x 65, and for an addition to the blacksmith shop, 70x112, brick with steel truss roof. Cost, $12,000.

Plans have been prepared for the Malleable Iron Co. at Marion, O., for two brick shops. The cost of both will be $11,000.

The Confectioners' Tool Mfg. Co., Kansas City, Mo., is to erect a new building. It will have its own foundry, lumber yard and dry kiln.

The Harrison Safety Boiler Works will build a foundry addition 25 x 64 feet, at 17th st. and Allegheny ave., Philadelphia.

The Brown Hoisting & Conveying Machine Co., of Cleveland, has an addition under way.

The Schneider & Trenkamp Co., of Cleveland, will shortly open bids for a $10,000 addition to its plant.

It is reported that the Kansas City, Pittsburg & Gulf Railroad will erect additional shop buildings at Pittsburg, Kan., one of which will be a brick building, 100x142 feet in size and will be especially fitted for rebuilding, repairing and painting

coaches. A brass foundry is also to be built. R. Gilham is general manager and chief engineer, Kansas City, Mo.

The Hill Clutch Co., of Cleveland, has begun work on an addition to its plant.

At York, Pa., the old foundry of the Pennsylvania Agricultural Works is being torn down to make way for a modern plant.

The J. G. Wagner Co., Milwaukee, has purchased a site 200x346 feet and will erect a foundry with a capacity of 30 tons a day. It will cost about $60,000.

The Baush & Harris Machine Tool Co., of Springfield, Mass., is building an addition which will be used by its erecting and shipping departments and for storage purposes as well. The new building will be equipped with a traveling crane similar to cranes now in use in the manufacturing departments.

The Marinette (Wis.) Iron Works Mfg. Co. has started its foundry at full capacity. Work has begun on an addition 50 x 50 feet which will greatly add to foundry capacity.

Fires and Accidents :—

A 30-horse power boiler, in the foundry ot Weidwig & Co., Zanesville, O., exploded Oct. 4. Damage, $3,000.

The Portland Rolling Mill at Portland, Me., was destroyed by fire Oct. 2. Loss, $75,000; insurance, $57,000.

The Pittsburg District :—

The bolt and nut works of Marland, Neely & Co., Pittsburg, were almost entirely destroyed by fire Saturday night, entailing a loss of $40,000, covered by insurance. The firm was rushed with orders and will rebuild at once.

The foundry of S. Jarvis Adams, Pittsburg, making a number of specialties, has been purchased by a number of Pittsburgers, who are incorporating the S. Jarvis Adams Co. to continue the business. Among those interested are Henry C. Fownes, of the Carrie Furnace Co.; J. Ramsey Speer, of the Shoenberger Steel Co.; W. C. Fownes, Jr, Joseph McK. Speer, and Charles McKnight. H. C. Fownes will be president, J. Ramsay Speer vice president, Charles McKight treasurer, and W. C. Fownes, Jr., secretary. The reports that the plant would be sold to the Shoenberger Steel Co. or some other concern are denied.

Ground has been broken for the new plant at Rankin, Pa., of the Baker Chain & Wagon Iron Mfg. Co. The main building will be 80 x 360 feet; winding and cutting department, 80 x 60 feet; packing room, 50 x 80 feet, and there will also be a power house and office. Gas engines will be used for power.

Some time ago Thomas W. Fitch, Jr., of Braddock, Pa., began the erection at Rankin, Pa., of a plant for the manufacture of steel shafting. The project has now been placed in the hands of a stock company just chartered, known as the Pittsburg Steel Shafting Co., with $100,000 capital stock. The buildings are completed and some of the machinery is in place. The main building is 170 x 60 feet. Officers of the company have not yet been elected. The directors are Thomas W. Fitch, Jr., J. Presley Fleming and Arthur L. Over.

Efforts are being made to combine the manufacturers of vehicle springs and axles. At the head of the movement is A. Leo Weil, a Pittsburg attorney. In a newspaper interview it is stated that the plants are to be acquired at their actual value. While refusing to give a list of the properties to be included, the promoters say the combine will include all in the country.

The Hydraulic Machine Co., Pittsburg, has shipped a large shear for metal cutting purposes. It is one of a pair built for the Crozer Iron & Steel Co., of Thurlow, Pa., and has a 12-ft. opening. It weighs, without its bed, 125 tons.

A New York dispatch says that representatives of the chain manufacturers of the country, including three from Pittsburg companies—the Garland Chain Co., James McKay & Co., and the Baker Chain & Wagon Iron Mfg. Co.

The building of the two 106x23-ft. blast furnaces at Rankin, Pa., by the Carnegie Steel Co., Ltd., announced last week, will give Allegheny county a total of 32 stacks, with a total capacity of 3,850,000 gross tons, of which the Carnegie company will own 19, with a total capacity of 2,700,000 tons, or about 70 per cent of the entire producing capacity of Allegheny county. With the addition of the new furnaces the four blast furnace plants of the Carnegie company will comprise the following: Edgar Thomson, nine stacks, 1,000,000 gross tons per annum; Duquesne furnaces, four stacks, 800,000 gross tons; Carrie furnaces, four stacks, 700,000 gross tons; Lucy furnaces, two stacks, 200,000 gross tons. Total, 2,700,000 gross tons of pig iron per annum.

The rod mill of the American Steel & Wire Co., at Beaver Falls, Pa., idle since April 7, will resume this week.

The H. K. Porter Co. has an order for three steel works locomotives for the Newburg, O., works of the American Steel & Wire Co.; also an order of five contractors' locomotives for Messrs. Nawn & Brock, of Boston, for use on a large water works contract in Brighton. It is also building a little engine for 18-inch gauge, having cylinders 6x10 inches, for the French Rand Gold Mining Co., of Johannesburg, South Africa, and has just shipped a 7x12-inch locomotive for 30-inch gauge to Japan. A 7x12-inch compressed air locomotive for 21-inch gauge has been shipped to the Commonwealth Iron Co., for work at the mines at Norway, Mich., as described elsewhere. A 11x14-inch consolidation locomotive has been shipped to Russia to run on track with a gauge of 29½ inches.

The Union Steel Casting Co., of Pittsburg, Pa., has been granted a permit for a one-story steel foundry building on 61rst st. Cost, $10,000.

Chicago District and Northwest :—

The Duluth blast furnace has been repaired and is being put in readiness to begin operation. A large quantity of coke has been received by rail from Connellsville, Pa.

A portion of the plant of the Federal Steel Co., at Joliet, Ill., has been shut down for a week for repairs.

Improvements are being made at Minerva Furnace, Milwaukee—a new blowing engine and additional boilers—which will increase the output to 100 tons a day.

A conference between foundrymen and the striking molders at Milwaukee last week resulted in a settlement of the strike. The clause providing for a shop committee to settle disputes was stricken out and the employers agreed to pay the floor molders $2.75 per day and the bench molders $2.50, and to give the piece workers an advance of 10 per cent. An agreement to that effect was signed by the foundrymen. It was dated Oct. 1 and will continue in force until April 30, 1900. The agreement will affect about 2,500 men.

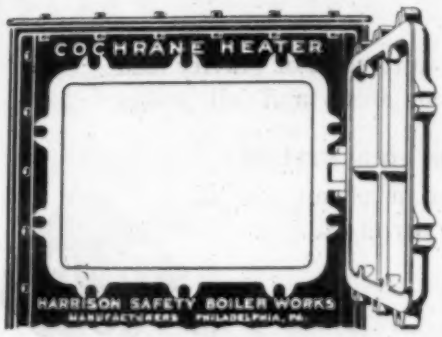
General Industrial Notes:—

The Wellsville (O.) Plate & Sheet Iron Co. will add 10 sheet mills to its plant. The polishing department will be increased by a 120-ft. building. Three new boilers will be added.

The White River Rolling Mill Co., Muncie, Ind., has collected about $19,000 and has distributed $16,000 to the creditors. During the period that the mill was operated in behalf of the creditors, a loss of $30,000 was incurred. The plant now belongs to the Republic Iron & Steel Co.

The New Era Iron Works Co., of Dayton, O., manufacturer of the New Era gas and gasoline engines, has recently purchased a new plant, which it is now remodeling and equipping with all the latest improved machinery. The demand for the New Era engine has been such as to compel this action, and by Jan. 1 the company's capacity will be doubled and it will have one of the most complete gas engine plants in the country.

Following is an extract from the prospectus of the Birdsboro Iron & Steel Co., incorporated at Trenton last month, capital $3,000,000, to take over the E. & G. Brooke Iron Co. properties at Birdsboro, Pa.: Two blast furnaces in successful operation, making about 175 tons of pig iron per day, and having a sufficient supply of ore bought to run them well into the spring of 1900. Connected with one of these is a Bessemer steel plant, with all machinery for making from 75 to 100 tons of steel per day, a rolling mill to produce from 75 to 80 tons of puddled bars per day; also a plate mill for rolling from 75 to 100 tons per day of nail plate and skelp; a nail factory making 1,200 kegs of cut nails per day; the diamond drill and machine works, for the manufacture of all kinds of castings and machinery, diamond drills, Royal rock crushers and Jackson belt lacers. The capital stock is in $5 shares. The former owners retain a one-fifth interest. Of



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Some hundreds of thousands of horse power of COCHRANE HEATERS are demonstrating in every day service that it is possible to greatly improve any boiler feed supply, no matter how bad. This to remind you that we have not forgotten the other points that go to make up a really good feed-water heater and purifier.

We shall be pleased to receive your inquiries, with particulars of your requirements.

HARRISON SAFETY BOILER WORKS,

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the proceeds of the issue, $1,150,000 will be used as working capital. The officers are Robert E. Brooke, president; Col. A. Loudon Snowden, vice-president. The organizers estimate a net profit at current prices in excess of $657,400 a year.

The Tyler Pipe Works, Anniston, Ala., owned by the Central Foundry Co. of 100 Broadway, New York, will double capacity and increase the output to 25 tons a day.

The plant and real estate of the Consolidated Pump Co., at Millington, Tenn., was bid in by the Memphis Savings Bank and Memphis National Bank, for $4,000.

It is reported that the American Steel & Wire Co., will move the machinery from the Findlay, O., mills, which have been closed, to Cleveland Pennsylvania mills.

The Weimer Machine Co., Lebanon, Pa., is working full time and some departments until 10 P. M. Within the past year it has refused $100,000 of work because it could not fill the orders.

Statistics of Lorain, O., industries recently collected show that the Lorain Steel Co. employs 3,041 men, Lorain Foundry Co. 215, Lorain Stove Works 105, American Shipbuilding Co. 592.

The Alabama Iron Co., located at Langdon, Ala., has leased the Langdon furnace and ore properties. Two washers are already on the property and another will be erected.

The furnace of the Alabama Consolidated Iron & Coal Co., at Ironton, Ala., which is being rebuilt, will be put in blast in two weeks. A large stockhouse of 100,000 tons capacity has just been completed and two large steam shovels put at work at the ore property.

It is stated that negotiations are under way for the transfer of the Dickson Mfg. Co.'s shops at Scranton, and Wilkes-Barre, Pa., to the Midvale Steel Co. The latter company is to take the plant in consideration of assuming the bonded and floating indebtedness, amounting to $1,500,000. It is stated that the Midvale company is acting for other parties.

The Sanderson Bros. Steel Co., Syracuse, N. Y., is putting up two additional 24-pot crucible melting furnaces with the necessary producers. A large wire drawing department for making fine wire for tool purposes has been in active operation for the last two months.

The Hercules Pipe Works at Anniston, Ala., recently purchased by the Hercules Iron & Supply Co., and which has been idle for four months, will soon resume operation.

C. R. Baird & Co., of Philadelphia, expect to blow in the Roanoke and Emporium furnaces toward the middle of the current month. The two Chickies of this company are now being repaired and will be making iron the latter part of the month.

The recently incorporated Sharon (Pa.) Steel Co. has elected the following officers: F. H. Buhl, president; George W. Darr, Pittsburg, vice-president; V. M. Delamater, secretary, and David Adams, treasurer. The directors are as follows: F. H. Buhl, David Adams, Niven McConnell, James S. Fruit, H. P. Forker, William L. Wallis, C. L. Magee, William Flinn and George Darr. The Shiffler Bridge Co., Pittsburg, has the contract for the buildings. The Riter-Conley Mfg. Co., Pittsburg, will erect the blast furnace, which is to be of 600 tons capacity and to have four stoves. William Tod & Co., Youngstown, have the contract for the two steeple type compound blowing engines for the furnace, and the blooming mill engine. The blooming mill contract goes to the Lloyd-Booth company, Youngstown.

There is some trouble in Amalgamated Association ranks at Youngstown over the puddlers exceeding the limit of output it being claimed that the day and night turns follow each other without any intermission and make 3,400 pounds each instead of 2,240 pounds. The charter of the lodge at the lower mill of the Union Iron & Steel properties has been suspended pending investigation.

The Empire Iron & Steel Co. has acquired the Shenandoah Furnace property at Shenandoah, Va., which comprises 31,000 acres of ore land in Page and adjoining counties of Virginia, on the line of the Norfolk & Western Railroad, and the Gem Furnace of 35,000 tons annual capacity. Repairs on the fur-

$50 FOR YOUR ESTIMATE

if correct.

Quite a wide difference of opinion exists among those interested in pig iron regarding the probable output during this year.

To encourage our friends to obtain accurate information and to form an estimate, WE OFFER FIFTY DOLLARS to the one who will during the month of October, 1899, send us an estimate of total production of pig iron in the United States for year ending December 31st, 1899, that shall prove to be nearest the actual output as shown by report of American Iron & Steel Association.

If several estimates are correct or nearest correct the money will be equally divided between them.

All estimates are to be sent to our Cincinnati office.

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nace are well under way and it is expected that it will be in blast by Dec. 1.

After an idleness of two years the foundry of the National Mfg. Co. in North Huntsville, Ala., will be placed in operation by local capitalists.

David Halley, J. O. Yates and Isaac Yates have closed an agreement with the Ironton Coal & Iron Co., for the lease of Vesuvius Furnace, near Ironton, O., and expect to take charge about Nov. 1. The furnace will be operated as the Vesuvius Charcoal Iron Co.

J. J. Albright, of Buffalo, who bought the land for the new proposed steel plant at Stony Point, south of Buffalo, in which Lackawanna Iron & Steel Co. holders are prominent, tells Buffalo papers that work on the plans has been progressing steadily and that a meeting for organization will be held in the near future.

The Berger Mfg. Co., Canton, O., manufacturer of sheet metal roofing, siding and ceiling, eave troughs, conductor pipe, etc., and operator of the largest sheet metal plant in the world, has been running overtime since March, much of the time having both a day and a night force employed.

The Cleveland Crane & Car Co., of Cleveland, has recently instattled a 10-ton, three-motor electric traveling crane in the foundry of the James Leffel Co., Springfield, O., and a crane of the same capacity and description in the Dayton Globe Iron Works, Dayton, O.

The Rankin Iron & Machine Works, of Port Carbon, Pottsville, Pa., have signed a contract to furnish the American Steel & Wire Co. with four pairs of 24 and 26 engines.

The Lloyd Booth Co., of Youngstown, O., has taken a $75,000 contract for equipment for the new plant of the Buhl Steel Co., at Sharon, Pa.

No. 2 furnace of the Sloss Iron & Steel Co., at Birmingham, Ala., went in blast last week.

The Ohio plant of the National Steel Co. made 4,590 heats in September, on several turns breaking its record. The converting mill turned out 46,876 tons of material for the mills, of which 21,042 tons were rolled into tin bars and small billets and 29,235 tons into larger billets. The total output of the finishing mills was thus 41,277 tons.

The time for stockholders' assent to the Pottstown (Pa.) Iron Co.'s proposal to incur $1,000,000 indebtedness in building an open-hearth steel plant has been extended.

Recent sales of Peter Gerlach & Co., of Cleveland, include numerous stave saws, heading machines and stave outfits. Among the purchasers are Bruce Meyer, Boscobel, Wis.; Crescent Mfg. Co., Muskegon, Mich.; Clark Benjamin & Co., New Bremen, O.; Geo. W. Morris, Mapesville, Va.; A. J. Epperley & Co., Williamson, W. Va.; E. & B. Holmes, Buffalo, N. Y.; B. F. Fulghunn, Cranesville, Tenn.; Ault Lumber Co., Charleston, W. Va.; Cowles & Cozad, Wilkesboro, N. C.; Walker & Caldwell, New Castle, Va.; W. H. Coleman Co., Memphis, Tenn.; B. F. Borden, Overall, Va.; Okey Meadows, Northampton, W. Va.; Bauer Cooperage Co., London, O.; Dudley & Shlewburg, Greenfield, Tenn.; Trexler Cooperage Co., Lancaster, Pa.; Weidman Cooperage Co., Brooklyn, N. Y.; John H. Foulk, Galliopolis, O.; E. & F. Glor, Buffalo, N. Y.; Chess & Wymond Co., Louisville, Ky.; W J Fell, Huntingdon, W. Va.

The prospectus of the Alabama Consolidated Coal & Iron Co. says that the company will control 70,000 acres of land, of which more than 5,000 acres contain iron ore. Workable seams of high grade cal underlie 18,000 to 24,000 acres. The company will also own 26,000 acres of well stocked pine timber land. Experts report that an amount of ore on the land adjacent to the Clifton plant is sufficient to supply half a dozen furnaces for 50 years. The coal resources are estimated to be large enough to supply 600,000 fires a year for 150 years. Engineers have computed the supply of coal in two seams in one area to be at least 12,880,000 tons. It is also proposed to build from 300 to 400 new coke ovens, new coal washers, and provide all appliances requisite for the enlarged plant and for the purpose of manufacturing coke

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HIGH GRADE CASTINGS. QUICK DELIVERIES.

BUHL MALLEABLE CO., Detroit, Mich.

sufficient to run the furnaces of the properties. With only one of four furnaces in blast and with the Standard Coal Co. operating to only one-fourth of its immediate capacity the properties are earning from $25,000 to $30,000 per month net profit. The management of the properties will continue in the hands of T. G. Bush, of Anniston, Ala., formerly president of the Clifton Iron Co., and F. M. Jackson, formerly manager of the Standard Coal Co.

An official of the American Steel Hoop Co. is quoted as authority for the statement that the business of the company for the fiscal year which ends in April, will aggregate something like $35,000,000 Of this amount it is estimated that between $5,000,000 and $6,000,000 will be clear profit. The output of finished and raw material is about 3,000 tons daily, and for the fiscal year will be in the neighborhood of 900,000 tons; 188,000 tons of finished material and 100,000 tons of pig iron are on the books for future delivery. The raw material being used was purchased early in the year when prices were lower. The advance in the price of raw material alone has netted the company a very large sum. It requires nearly a million dollars to pay the preferred dividend. Making allowance for expenditures in fortifying its position, new plants, etc., the company will earn between 10 and 15 per cent on the common stock. Nothing will be done in the way of a dividend on the common stock until the close of the fiscal year, at least.

The Kellogg Weldless Tube Co.'s plant at Findlay, O., has been purchased by the Heckert-Baltsley Steel Billet Co. Some new buildings will be added, and the old ones repaired and painted. The machinery is all being overhauled, and considerable new machinery will be added for a variety of products in hollow structural shpes, composing an entirely new departure. A No. 1 Heckert universal tube rolling mill, under construction at the works of the Robert Poo'e Sons Co., Baltimore, Md., is to be completed for operation within four months. This mill will roll every diameter and thickness of

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THE Fort Wayne Electric Works, of Fort Wayne, Ind., are now manufacturing an arc lamp called the "Chicago" pattern, which was designed by J. J. Wood to meet the requirements of E. B. Ellicott, city electrician of Chicago. This lamp is of the shunt feed type and contains a number of original features in its construction. It is very efficient, little energy being consumed in the operating magnets. The lamp weighs 36 pounds, complete with globe and carbons, and was designed for pole suspension. Several thousand of these lamps will be used in Chicago.

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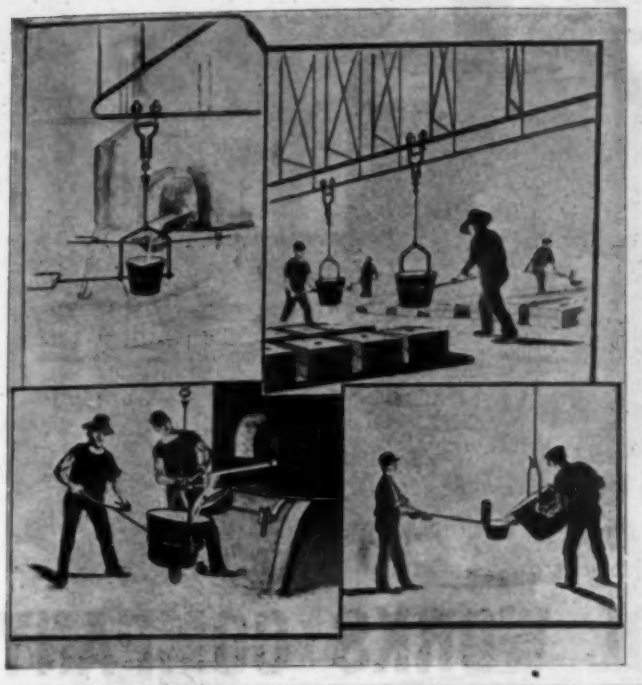
October 24th and 25th low rate non-transferable excursion tickets will be sold to Cincinnati from Pennsylvania Lines ticket stations in Ohio, for the State Baptist Convention, good to return until Friday, October 27th.

$1.50 to Wheeling and Return via C. T. & V. and B. & O. R. R.

Sunday October 15th. Special train leaves Cleveland Depot, foot of South Water St. at 7:00 A. M. Returning leaves Wheeling at 7:00 P. M.

Foundries



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Carnegie Steel Company, Ltd., Duquesne, Pa.	4	2,400	Double.
Carnegie Steel Company, Ltd., Edgar Thompson	9	3,500	Six.
Carnegie Steel Company, Ltd., Rankin (Carrie)	2	700	Double.
Carnegie Steel Company, Ltd., Pittsburg (Lucy)	2	800	Double.
Struthers Furnace Company, Struthers, O.	1	303	Single.
Laughlin & Co., Ltd., Pittsburg, Pa. (Eliza)	5	2,000	Double (2).
Oliver & Snyder Steel Company, Pittsburg, Pa. (Edith)	1	400	Double.
Oliver & Snyder Steel Company, New Castle, Pa. (Rosena)	1	400	Double.
Shenango Valley Steel Company, New Castle, Pa.	2	800	Double.
Bellaire Steel Company, Bellaire, O.	2	700	Double.
Lebanon Furnaces, Lebanon, O.	2	800	Double.
Tennessee Coal, Iron & Railroad Company, Ensley, Ala.	4	800	Double.
Riverside Iron Works, Wheeling, W. Va	2	700	Double.
American Steel & Wire Co.	7	3,000	Double (3)
Totals	46	17,700	

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Uehling Method

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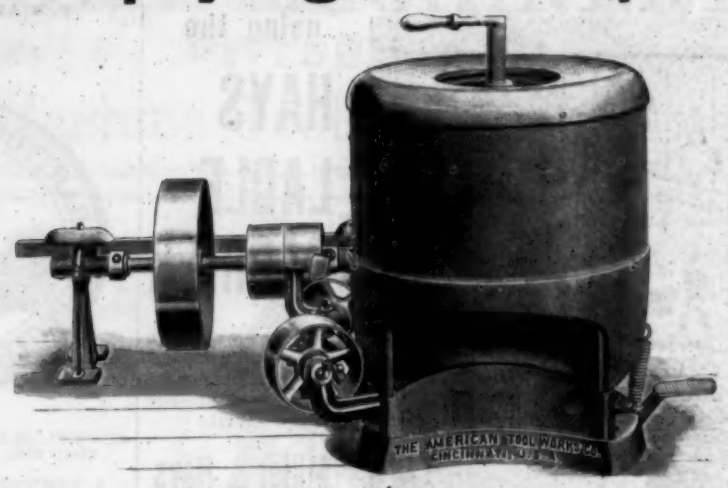

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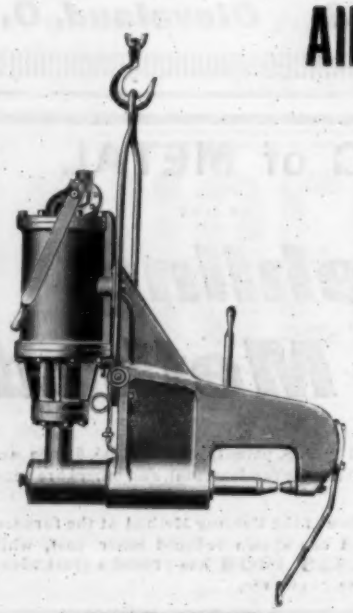

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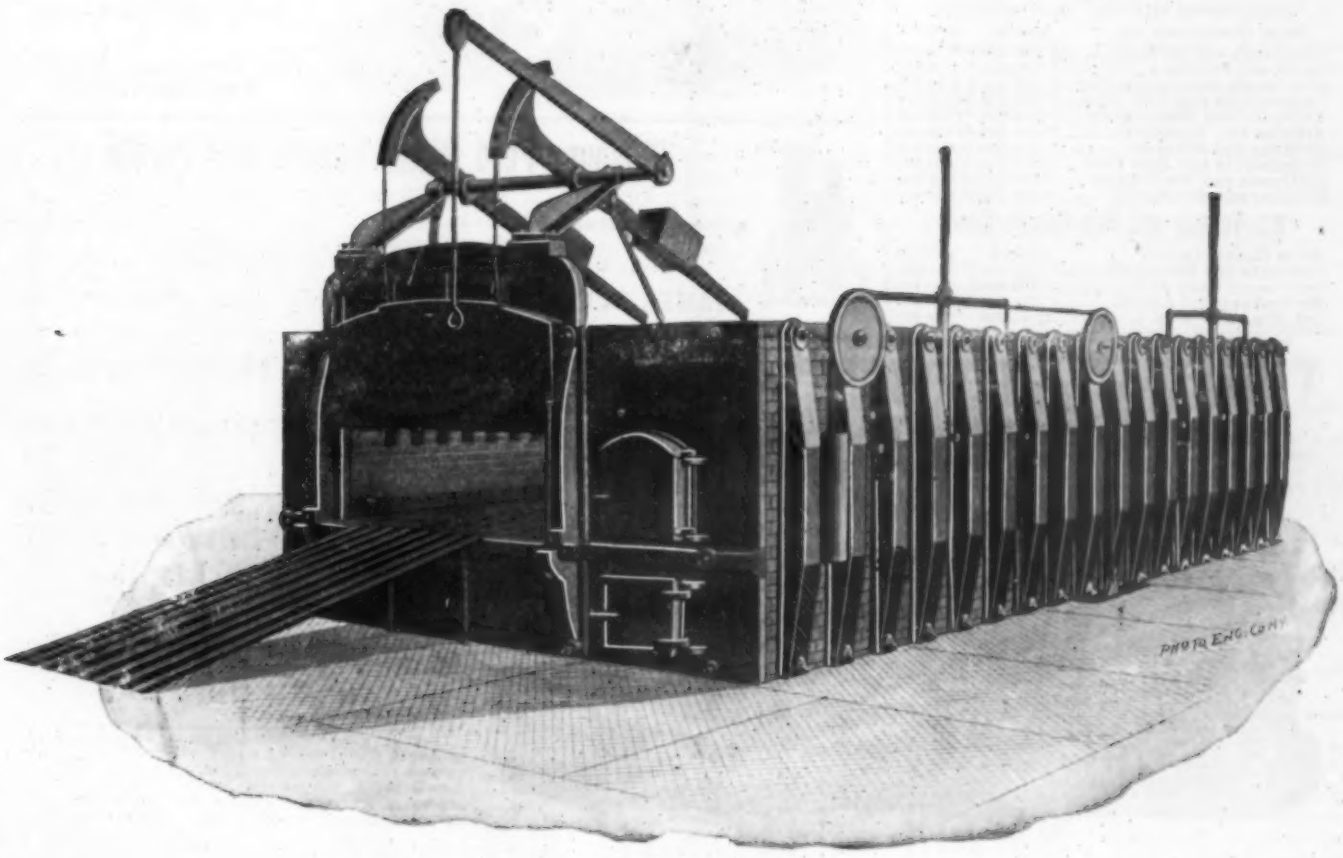

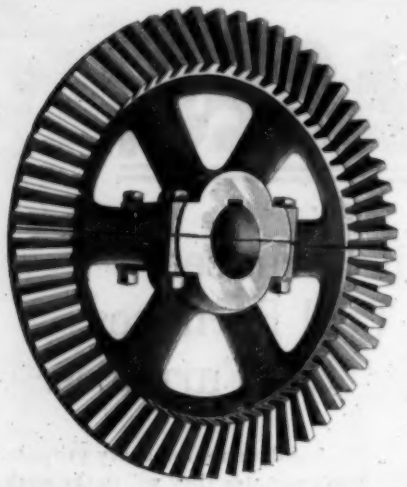

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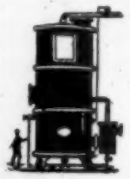

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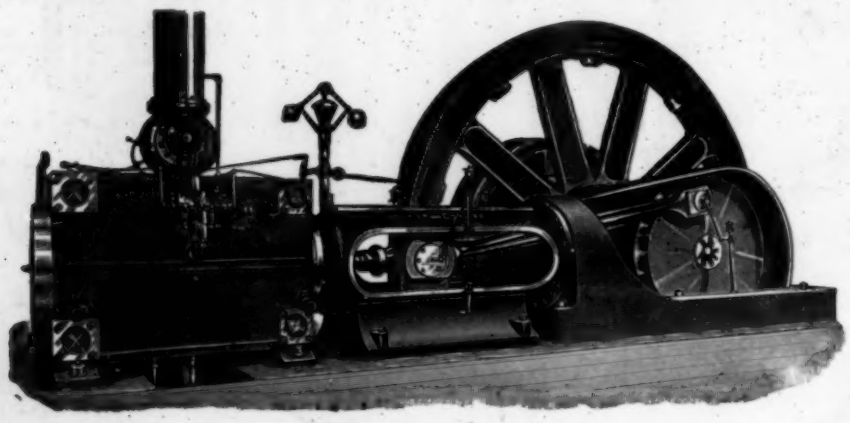

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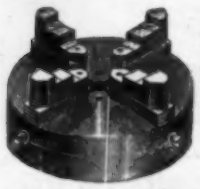

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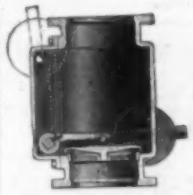

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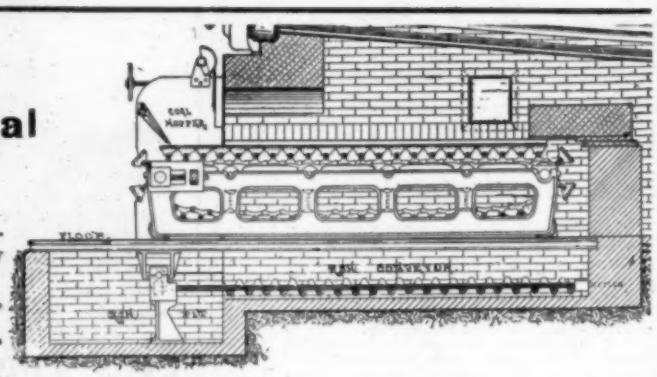

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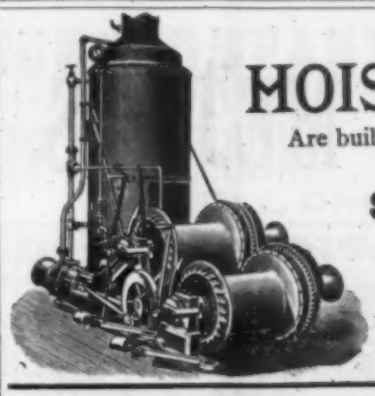

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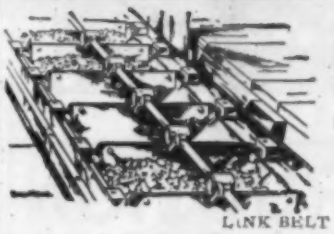

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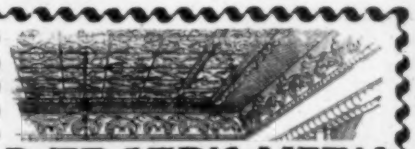

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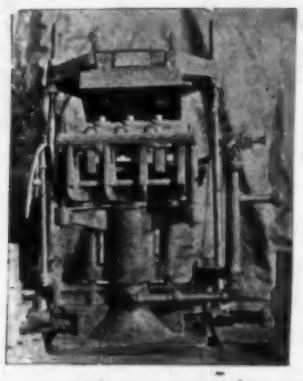

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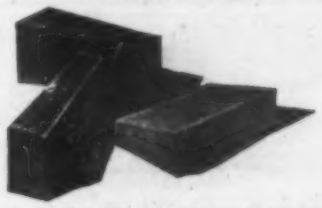

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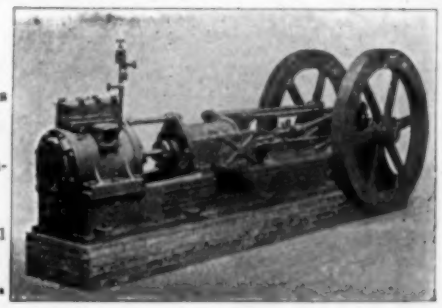

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The American Iron and Steel Association has just completed a thorough revision of its Directory to the Iron and Steel Works of the United States, bringing down to April, 1898, a description of these works. It also contains a complete Directory to many leading industries which are large consumers of iron and steel. This edition, which is the fourteenth that has been issued, embraces more complete details of all the iron and steel works of the United States, and of industries which are large consumers of iron and steel, than any preceding edition. It retains all the old features of preceding editions and contains many new features.

In the edition for 1896 there was given for the first time a complete list of Malleable Iron Works in the United States, and to this new feature there are now added complete lists of the Rail Mills, Structural Mills, Steel Casting Works, Bolt, Nut and Rivet Works, Chain Works, Seamless Tube Works, and Riveted Pipe Works—all new features.

The lists of Plate and Sheet Mills and of Tin Plate and Stamping Works are much more complete than in previous editions. The names and location of all the works described are given in alphabetical order, followed by a description of their character, capacity and products, with the names of the principal officers, etc., including the names of selling agents. This edition makes a cloth-bound book of nearly 400 well-printed pages—many more than in any previous edition. It contains a complete list of all the

Blast Furnaces,
Rolling Mills,
Bessemer Steel Works,
Open-Hearth Steel Works,
Crucible Steel Works,
Plate and Sheet Mills,
Rail Mills,
Structural Mills,
Steel Casting Works,
Cut-Nail Works,
Tin Plate Works,
Stamping Works,
Forges and Bloomaries,
Wire Rod and Wire Mills,
Wire Nail Works,
Iron and Steel Bridge Builders,
Iron and Steel Ship Builders,
Horse-Nail Works,
Locomotive Works,
Malleable Iron Works,
Cast Iron Pipe Works,
Cast Iron Soil and Plumbers' Pipe Works,
Wrought Iron, Wrought Steel and Riveted Pipe Works,
Seamless Tube Works,
Chain Works,
Bolt, Nut and Rivet Works,
Car Axle Works,
Car Wheel Works, and
Car Builders in the United States

ALSO A LIST OF THE

Iron and Steel Works in Canada and Mexico.

This edition of the Directory is an invaluable book of reference for all business men who wish to correspond with iron and steel manufacturers or with iron and steel consumers, forming, in every respect, a COMPLETE GUIDE to the iron and steel works of this country and to the principal works which consume iron and steel.

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OF THE
Iron and Steel Directory

Published by
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That is the testimony of the shrewdest and livest of them.

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Special low-phosphorus hard ore, Bessemer	$5.50
No. 1 Specular, Bessemer	$4.25@ 5.00
No. 1 Bessemer, hematite	4.00@ 4 75
Hematites No. 1 non-Bessemer	3.50@ 3 75
No. 1 Specular, non-Bessemer	3.50@ 4.00
Mesabi Bessemer	3 50@ 4.00

PIG IRON.

Cleveland (f. o. b. cars):

Bessemer	$24.00
No 1 Strong Foundry	$23 00@ 23.50
No. 2 Strong Foundry	23.00@ 23.75
Gray Forge, red short	21.35@ 21.75
No. 1 American Scotch	23 00@ 23.50
No 2 American Scotch	22.25@ 22.75
Lake Superior Charcoal	25.00@ 29.00

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[Delivered Cleveland.]	Gross Tons
Old iron rails	$30.00
Old steel rails (6 ft. and over)	21.00
Old steel rails (6 ft. and under)	23.00
Old car wheels	19.00
	Net Tons.
No. 1 R. R. wrought scrap	$22.00
Mill scrap	17.00
No. 1 Machine cast scrap	16.00
Iron axles	27.00
Axle turnings	16.00
Wrought turnings (free from cast)	13.00
Cast borings	11.00
Uncut wrought iron boilers	16.00
Steel boiler plates	16.00
Grate bars	11.00
Pipes and flues (clean)	15.00
Tank Iron	16.00
Hoop and band iron	13.00
Sheet iron	10.00
Wrought drillings	13.00
Malleable iron	15.00

STRUCTURAL MATERIAL.

Beams and channels (f. o. b. Cleveland)	2.35c
Angles	2.35@ 2.45c
Tees	2.45c
Universal plates	3.00c
Sheared plates	3.00c

MERCHANT IRON & STEEL.

[Less than car-lots, Cleveland.]

Rounds and Squares—Bar Iron.

1 to 1⅞	3.50 Base.
2 to 2⅞	.20 extra.
3 to 3½	.50 "
3¾ to 4	.80 "
4¼ to 4½	1.00 "
4¾ to 5	1.30 "
5¼ to 6	1.80 "
6¼ to 6½	2.20 "
6¾ to 7⅛	2.50 "
¼ to ⅜	.10 "
⅜ to 11-16	.20 "
⅝ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13 2	.50 "
5-16 to 1 -32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1¼ to 4 x ⅜ to 1	1.05 Base
4¼ o 6 x ⅜ to 1	.10 extra
6¼ o 8 x ⅜ to 1	.60 "
8¼ o 10 x ⅜ to 1	.80 "
1¼ o 4 x 1 1-16 to 1½	.30 "
4¼ to 6 x 1 1-16 to 1½	.40 "
6¼ to 8 x 1 1-16 to 1½	.60 "
8¼ to 10 x 1 1-16 to 1½	.90 "
2 to 4 x 1⅝ to 2	.50 "
4¼ to 6 x 1⅝ to 2	.60 "
6¼ to 8 x 1⅝ to 2	.80 "
8¼ to 10 x 1⅝ to 2	1.00 "
2 to 4 x 2⅛ to 3	.60 "
4¼ to 6 x 2⅛ to 3	.80 "
6¼ to 8 x 2⅛ to 3	1.00 "
1⅛ to 1⅜ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅝	.20 "
¾ to 15-16 x ⅜ to ¼	.40 "
⅝ to 11-16 x ⅜ to ½	.50 "
½ to 9-16 x ⅜ to ⅝	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4¼ to 6 x ¼ to 5-16	.30 "
1⅝ to 4 x ¼ to 5-16	.20 "
1 to 1⅜ x ¼ to 5-16	.30 "
¾ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
½ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5-16 thick. Bevel Edge Shaft Iron 1-10 higher than same size of Heavy Bands.

Light Band Iron.

7 to 8 x No. 9 to 3-16	.90 extra
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1¼ to 4 x No. 9 to 3-16	.40 "
1¼ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	.60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos. 10, 11 and 12	1.10 "

7-16 to ½ x No. 9 to 3-16.....1.30 extra
7-16 to ½ x Nos. 10, 11 and 12.....1.40
½ x No. 9 to 3-16.....1.50
½ x Nos. 10, 11 and 12.....1.60

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in.....
Sand Band Iron, 1-10 c. above same sizes of Light Bands.

Oval Iron.

⅜ to 1½.....40 extra
⅜ to 13-16.....50 "
⅜ to 11-16.....60 "
⅜ to 9-16.....80 "
⅜ to 7-16.....1.10 "
½ to 9-16 x 3-16.....1.00 "
½ to 11-16 x ⅜.....1.20 "

Half Oval and Half Round.

2¼ to 3.....60 extra
⅜ to 2.....50 "
½ to 13-16.....70 "
⅝ to 11-16.....90 "
½ to 9-16.....1.20 "
¾ to 7-16.....2.50 "
5-16.....3.50 "
¼.....4.50 "

Half Ovals less than ¼ their width in thickness extra price.

Horse Shoe Iron.

All sizes.....1 c. extra.

Cutting ordinary bars to specified length, .20 to .30 extra, according to length and size.

Steel Bands.

Width in Inches.	English Standard Gauge.		
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16"	1.50	Base.
			Extras.
1¼ to 6,	" 10, 11, 12 or ¼"	.05	per 100 lbs
1 to 1¾,	" 7, 8, 9 or 3-16"	.10	"
1 to 1¾,	" 10, 11, 12 or ¼"	.15	"
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20	"
13-16 and ⅞,	" 10, 11, 12 or ¼"	.25	"
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30	"
11-16 and ¾,	" 10, 11, 12 or ¼"	.35	"
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40	"
9-16 and ⅝,	" 10, 11, 12 or ¼"	.45	"
½,	Nos. 7, 8, 9 or 3-16"	.55	"
½,	" 10, 11, 12 or ¼"	.60	"
7-16	" 7, 8, 9 or 3-16"	.75	"
7-16	" 10, 11, 12 or ¼"	.85	"
⅜,	" 7, 8, 9 or 3-16"	.95	"
⅜,	" 10, 11, 12 or ¼"	1.05	

Iron and Steel Hoops.

Width Inches.	English Standard Gauge.		
7-16 to 3	Nos. 13, 14, 15 and 16.....	1.60	Base
			Extras.
7-16 to 2,	" 17, 18, and 19.....	.05	per 100 lbs
7-16 to 2,	" 20	.10	"
7-16 to 2,	" 21	.15	"
7-16 to 1¾,	" 22	.25	"
½ to 1¾,	" 13, 14 and 15.....	.05	"
	" 16, 17 and 18.....	.10	"
1¼ to 1¾,	" 19 and 20.....	.15	"
1¼ to 1¾,	" 21.....	.20	"
1¼ to 1¾,	" 22.....	.30	"
15-16 and 1,	" 13, 14 and 15.....		"
15-16 and 1,	" 16, 17 and 18.....	.15	"
15-16 and 1,	" 19 and 20.....	.20	"
15-16 and 1,	" 21.....	.25	"
15-16 and 1,	" 22.....	.35	"
¾,	Nos. 13, 14 and 15.....	.20	"
¾,	" 16, 17 and 18.....	.25	"
¾,	" 19 and 20.....	.30	"
¾,	" 21.....	.35	"
¾,	" 22.....	.45	"
¾ and 13-16	Nos. 13, 14 and 15	.30	"
¾ and 13-16	" 16, 17 and 18.....	.35	"
¾ and 13-16	" 19 and 20.....	.40	"
¾ and 13-16	" 21	.45	"
¾ and 13-16	" 22	.50	"
¾ and 13-16	" 23	.60	"
11-16,	Nos. 13, 14 and 15.....	.35	"
11-16,	" 16, 17 and 18.....	.40	"
11-16,	" 19 and 20.....	.50	"
11-16,	" 21.....	.60	"
11-16,	" 22.....	.70	"
11-16,	" 23.....	.80	"
⅝,	Nos. 13, 14 and 15.....	.40	"
⅝,	" 16, 17 and 18.....	.45	"
⅝,	" 19 and 20.....	.55	"
⅝,	" 21.....	.65	"
⅝,	" 22.....	.75	"
⅝,	" 23.....	.85	"
9-16,	" 13, 14 and 15.....	.45	"
9-16,	" 16, 17 and 18.....	.50	"
9-16,	" 19 and 20.....	.60	"
9-16,	" 21.....	.70	"
9-16,	" 22.....	.80	"
9-16,	" 23.....	.90	"
½,	" 13, 14 and 15.....	.55	"
½,	" 16, 17 and 18.....	.60	"
½,	" 19 and 20.....	.70	"
½,	" 21.....	.80	"
½,	" 22.....	.90	"
½,	" 23.....	1.00	"
7-16,	" 13, 14 and 15.....	.80	"
7-16,	" 16, 17 and 18.....	.90	"
7-16,	" 19 and 20.....	1.00	"
⅜,	" 13, 14 and 15.....	1.00	"
⅜,	" 16, 17 and 18.....	1.10	"
⅜,	" 19 and 20.....	1.20	"

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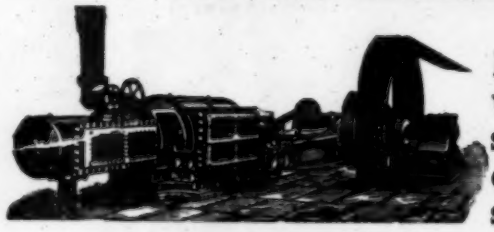

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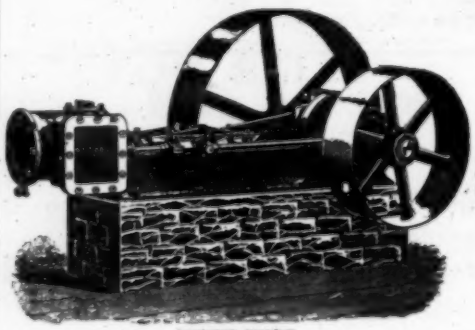

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Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O.
Robins Conveying Belt Co., New York City.

COMPAROMETERS—
Vulcan Mfg. Co., Pittsburg, Pa.

COMPRESSED AIR SHOP TOOLS—
Clayton Air Compressor Works, New York City.
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.
Q & C Co., Chicago, Ill.
American Pneumatic Tool Co., New York City.
Manning, Maxwell & Moore, New York City.

COMPRESSION COUPLINGS—
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.

CONTRACTORS FOR CLEANING BOILERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

CORE OVENS—
Millett Core Oven Co., Brightwood, Mass.

CORRUGATED IRON—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Cincinnati Corrugating Co., Piqua, O.

COTTON TIES—
American Steel Hoop Co., Pittsburg, Pa.

CRANES AND DERRICKS—
Northern Engineering Works, Detroit, Mich.
Wm. Tod & Co. Youngstown, O.
Marion Steam Shovel Co., Marion, O.
Reading Crane & Hoist Works, Reading, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Brown Hoisting and Conveying Machine Co. Cleveland, Ohio.
Excelsior Iron Works Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Cleveland Crane & Car Co., Cleveland, O.

CUPOLAS—
Riter-Conley Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.

DIES—
Danielson Machine & Tool Co., Cleveland, O.

DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.

DRILL GRINDERS—
J. Wendell Cole Columbus, O.

DRILL PRESSES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield Mass.
Manning, Maxwell & Moore, New York City.
Danielson Machine & Tool Co., Cleveland, O.

DROP FORGINGS—
Wyman & Gordon, Worcester, Mass.
Chicago Drop Forge & Foundry Co., Kensington, Ill.

DROP PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro., Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield, Mass.

DYNAMOS—
Jeffrey Mfg. Co., Columbus, O.

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.

ELEVATING AND CONVEYING MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O.
Buhl Malleable Co., Detroit, Mich.
Robins Conveying Belt Co., New York City.
Excelsior Iron Works Co., Cleveland, O.

EMERY AND CORUNDUM WHEELS—
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besley & Co, Chicago, Ill.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

EMERY WHEEL MACHINERY—
J. Wendell Cole, M.E., Columbus, O., or Chicago
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

ENGINEERS AND CONTRACTORS—
Wellman-Seaver Engineering Co., Cleveland, O.
Walter Kennedy, Pittsburg Pa.
Heyl & Patterson, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville, O
E. E. Erickson, Pittsburg, Pa.
John T. Jones & Co., Chicago, Ill.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.

ENGINE PACKING—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill.

ENGINEERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

ENGINE LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
American Tool Works Co., Cincinnati, O.

ENGINES (OIL)—
The Aultman Co., Canton, O.

ENGINES (STEAM)—
W. P. Davis Machine Co., Rochester, N. Y
Wm. Tod & Co., Youngstown, O.
The Edward P. Allis Co,, Milwaukee, Wis.
The Hooven, Owens & Rentschler Co., Hamilton, O.
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.

GEARING—
I. & E. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.

Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

ENGRAVERS AND ELECTROTYPERS—
Central Electrotype & Engraving Co., Cleveland, O.
National Engraving Co., Cleveland, O.,
Samuel R. Mason, Cleveland, O.

FEED WATER HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich

FILES, MAKERS OF—
C. H. Besly & Co., Chicago, Ill.

FIRE BRICK AND CLAY—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield, Pa.
Dover Fire Brick Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.
Chicago Fire Clay Product Co., Chicago, Ill
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit Mich.
Garden City Sand Co., Chicago, Ill
A. F. Smith & Co., New Brighton Pa.
Chas Taylor's Sons Co Cincinnati, O.

FIRE PROOF COVERING—
C H. Besly & Co., Chicago, Ill.

FLEXIBLE SHAFTS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FLUE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FORGINGS—
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Braeburn Steel Co., Braeburn, Pa
Wyman & Gordon, Worchester, Mass
Danielson Machine & Tool Co., Cleveland, O.

FOUNDRIES—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co, Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W.Va.
Excelsior Iron Works Co., Cleveland, O.
Macbeth & Co., Cleveland, O.

FOUNDRY EQUIPMENT.
Miller & Hays, Akron, O.
Tabor Mfg. Co., Elizabeth, N. J.
Millett Core Oven Co., Brightwood, Mass.
Brass Founders Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
King Improved Sand Blast Co., Detroit, Mich.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.

FOUNDRY SUPPLIES—
Northern Engineering Works, Detroit, Mich.
Chas. Taylor's Sons Co., Cincinnati, O.
Miller & Hays, Akron, O.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co, Cleveland, O.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland. O
A. F. Smith & Co., New Brighton, Pa.
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Millett Core Oven Co., Brightwood, Mass.
Cleveland Facing Mill Co., Cleveland. O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.
King Improved Sand Blast Co., Detroit, Mich.

FRICTION METAL—
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago. Ill.

FURNACES—
Playford Stoker Co., Cleveland, O.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FUEL OIL BURNERS—
W. S. Rockwell & Co., New York City.

GALVANIZED IRON—
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZERS—
Ætna-Standard Iron & Steel Co., Bridgeport, O
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Northern Engineering Works, Detroit, Mich.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GREASE—
A. F. Boettcher, Rowlands, Pa.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos Dixon Crucible Co., Jersey City, N. J.

GRATE BARS—
Geo. B Sennett Co., Youngstown, Ohio.

GRAY IRON CASTINGS—
W. A. Jones Foundry Co., Chicago, Ill
Brass Founders' Supply Co., Newark, N. J.

HACK SAWS—
Millers Falls Co., New York City.
Q & C Co., Chicago, Ill.

HANGERS—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HOISTS—
Reading Crane & Hoist Works, Reading, Pa.
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O

HOISTING MACHINERY—
Link-Belt Machinery Co., Chicago, Ill.
Reading Crane & Hoist Works, Reading, Pa.
Jeffrey Mfg. Co. Columbus, O.
Excelsior Iron Works Co., Cleveland, O.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.
Robins Conveying Belt Co., New York City.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.

HOTELS—
United States Hotel Co., Cleveland, O.

IMPULSE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Shiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.

IRON NAILS AND STEEL—
Bethlehem Steel Co., South Bethlehem, Pa.
C. H. Besly & Co., Chicago, Ill.
F. H. Stroud & Co., Chicago, Ill
Parkhurst & Wilkinson Co., Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport O.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland. O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.

IRON WORKING TOOLS—
American Tool Works Co., Cincinnati, O.
H. Bickford, Lakeport, N. H
C. H. Besly & Co., Chicago. Ill.
U. Baird Machinery Co., Pittsburg. Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Skinner Chuck Co., New Britain, Conn.
Baush & Harris Machine Tool Co., Springfield, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Cleveland Ball & Screw Co., Cleveland, O.
W. P. Davis Machine Co., Rochester, N. Y.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

LADLES—
Northern Engineering Works, Detroit, Mich.

LATHES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg. Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

LUBRICATORS—
A. F. Boettcher, Rowlands, Pa.

MACHINISTS' TOOLS AND SUPPLIES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Skinner Chuck Co., New Britain, Conn.
Baush & Harris Machine Tool Co., Springfield Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINE SHOPS—
The R. D. Nuttall Co., Allegheny, Pa.
H. A. Streeter, Chicago, Ill.
Danielson Machine & Tool Co., Cleveland, O.

MACHINERY AND TOOL STEEL—
C. H. Besley & Co., Chicago, Ill.
Braeburn Steel Co., Braeburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.

MALLEABLE CASTINGS—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.

MANUFACTURING CHEMISTS—
We Fu Go Co., Cincinnati, O.

MANUFACTURED IRON AND STEEL—
Bourne-Fuller & Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.

METAL BEARINGS—
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
Swarts Metal Refining Co., Chicago, Ills.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

MILLING MACHINES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis,
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Robins Conveying Belt Co., New York City.
Excelsior Iron Works Co., Cleveland, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co, Milwaukee, Wis.

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
W. S. Rockwell & Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.

ORE CARS—
The Pressed Steel Co. Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Co, Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers Chicago, Ill.

ORE SCREENS—
Seibel-Suesdorf Coyper & Iron Mfg. Co., St. Louis, Mo.
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
C. Wilford Peters, Cincinnat O.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland, O.

PERFORATED METALS—
Seibel-Suessdorf Copper & Iron Mfg. Co., St. Louis, Mo.
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.

PIG IRON—
Matthew Addy & Co., Cincinnati, O.
Rogers, Brown & Co., Cincinnati, O.
Reed F. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Forster, Waterbury & Co., Chicago, Ill.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill,
The Brier Hill Coal & Iron Co., Youngstown, O
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago Ill.

PIG IRON CASTING APPARATUS—
Heyl & Patterson, Pittsburg, Pa
G. H. Ginther, Special Agent, Pittsburg, Pa.

PIPE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn.

PLANERS—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.

PNEUMATIC TOOLS—
American Pneumatic Tool Co., New York City
Q & C Co., Chicago. Ill.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Vulcan Mfg. Co., Pittsburg, Pa.

POWER DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield Mass.

POWER PRESSES—
Bertsch & Co., Cambridge City, Ind.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

POWER TRANSMISSON MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
E. A. Delano, Chicago. Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

PRESSURE GAUGES—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.

PULLEYS—
W. A. Jones Foundry Co., Chicago, Ill
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.

PUMPS (STEAM)—
The Edward P. Allis Co., Milwaukee, Wis
Blakeslee Mfg. Co., Du Quoin, Ill,
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

PUNCHES—
E. Konigslow & Bro. Cleveland, O.

PYROMETERS—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

RADIAL DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

RAILWAY SUPPLIES—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.

RIVETS—
Champion Rivet Co., Cleveland, O.
Jonse & Laughlins, Ltd., Pittsburg, Pa.

RIVETED STEEL PIPE—
The Wm. B. Pollock Co. Youngstown, O.

ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York

ROLLING MILL MACHINERY—
Totten & Hogg Iron and Steel Foundry Co. Pittsburg, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa

ROOFS—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.

SAND BLAST MACHINES—
King Improved Sand Blast Co., Detroit, Mich.

SAWS—
Peter Gerlach & Co., Cleveland, O.

SCREENS FOR COAL, ORE, ETC.—
Robt. Aitchison Perforated Metal Co., Chicago
Harrington & King Perforating Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.

SCREWS—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill

SCREW MACHINES—
Cleveland Ball & Screw Co., Cleveland, O.

SEAMLESS TUBES—
Shelby Steel Tube Co., Cleveland, O.

SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa
Austin Separator Co., Detroit, Mich.

SHAFTING—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Bethlehem Steel Co., South Bethlehem, Pa.
American Steel & Wire Co., Chicago, Ill.

SHAPERS—
W. P. Davis Machine Co., Rochester, N. Y.
Baush & Harris Machine Tool Co., Springfield Mass.
American Tool Works Co., Cincinnati, O.

SHEARING AND PUNCHING MACHINERY—
Bertsch & Co., Cambridge City, Ind.
Danielson Machine & Tool Co., Cleveland, O.

SHEET IRON—
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O
E. H. Stroud & Co., Chicago Ill.
Republic Iron & Steel Co., Chicago, Ill.

SHIP YARDS—
Wm. Cramp & Sons, Philadelphia, Pa.

SPECIAL MACHINERY—
American Tool Works Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.
Q & C Co., Chicago, Ill
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
E. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va
Danielson Machine & Tool Co., Cleveland, O.

STAND PIPES—
The Wm. B. Pollock Co., Youngstown, O.

STEAM BOILER INSPECTORS—
Hartford Steam Boiler Inspection & Insurance Co. Hartford, Conn.

STEAM PIPE AND BOILER COVERING—
C. H. Besly & Co., Chicago Ill

STEAM PACKING—
C. H. Besly & Co., Chicago, Ill.

STEAM PUMPS—
Hall Steam Pump Co., Pittsburg, Pa.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

STEAM SEPARATORS—
James Bonar & Co., Pittsburg, Pa.
Austin Separator Co., Detroit, Mich.
Harrison Safety Boiler Works, Philadelphia, Pa.

STEAM SHOVELS AND DREDGES—
Marion Steam Shovel Co., Marion, O
The Bucyrus Co., South Milwaukee, Wis.

STEAM SPECIALTIES—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

STEEL—
Otis Steel Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Byron H. White, Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.

STEEL BLOOMS AND BILLETS—
American Steel & Wire Co., Chicago, Ill.

STEEL BALLS—
Cleveland Ball & Screw Co., Cleveland, O.

STEEL BANDS—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co Chicago, Ill.

STEEL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

STEEL CASTINGS—
Otis Steel Co., Cleveland, O.
Q & C Co., Chicago, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.

STEEL CEILINGS—
Berger Manufacturing Co., Canton, O.

STEEL HOOPS—
American Steel Hoop Co., Pittsburg, Pa.

STEEL PLANTS—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.

STEEL BLOOMS AND BILLETS—
Bethlehem Steel Co., South Bethlehem, Pa.
Ohio Steel Co., Youngstown, Ohio.
The Lorain Steel Co., Lorain, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
American Steel Hoop Co., Pittsburg, Pa.

STEEL STAMPS AND STENCILS—
J. H. Flaherty & Co., Cleveland, O.

STEEL TUBES—
Shelby Steel Tube Co. Cleveland, O.

STOKERS—
Playford Stoker Co., Cleveland, O.

TANKS—
Enterprise Boiler Co., Youngstown, O.
Meehan Boiler & Construction Co., Lowellville, O
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.

TANK CARS—
The Wm. B. Pollock Co., Youngstown, O

TIN AND TERNE PLATES—
E. H. Stroud & Co., Chicago, Ill.
American Tin Plate Company, Chicago, Ill.

TIN PLATE MACHINERY—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.

TOOL STEEL—
C. H. Besly & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

TRANSMISSION MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
W. A. Jones Foundry & Machine Co., Chicago, Il
Jeffrey Mfg. Co., Columbus, O
Dodge Mfg. Co. Mishawaka, Ind.
The Aultman Co., Canton, O.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.

TROLLEY TRACKS—
Northern Engineering Wotks, Detroit, Mich.
Miller & Hays, Akron, O.

TRUCKS—
Northern Engineering Works, Detroit, Mich.

TUBES—
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Shelby Steel Tube Co., Cleveland, O.
S. Fix' Sons, Cleveland, O.

TUBE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

TUBE WELDING—
S. Fix Sons, Cleveland, O.

TUMBLERS—
Northern Engineering Works, Detroit, Mich.

TURNBUCKLES—
Republic Iron & Steel Co., Chicago, Ill.
Cleveland City Forge & Iron Co., Cleveland, O

TWIST DRILLS—
C. H. Besly & Co., Chicago, Ill.

TWIST DRILL CASES—
Vulcan Mfg. Co., Pittsburg, Pa.

VALVES—
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Jenkins Bros., New York City
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

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We Fu Go Co., Cincinnati, O.

WIRE—
American Steel & Wire Co., Chicago, Ill.

WIRE COATING—
The Ironsides Company, Columbus, O.

WIRE FENCING—
American Steel & Wire Co., Chicago, Ill.

WIRE FILLER—
The Ironsides Company, Columbus, O.

WIRE MACHINERY—
S. W. Goodyear, Waterbury, Conn.

WIRE NAILS—
American Steel & Wire Co., Chicago, Ill.

WIRE ROPE COATING—
The Ironsides Company, Columbus, O.

WIRE ROPE FILLING—
The Ironsides Company, Columbus, O.

WOOD PULLEYS—
Dodge Mfg. Co., Mishawaka, Ind.

WROUGHT PIPE—
National Tube Works, McKeesport, Pa.

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Is one of the requisites of satisfactory results. In the expansion of business which is now noticeable in every section of the country, advertisers who have made themselves regularly prominent in the past two years will be first to reap the rewards of persistent publicity.

Alphabetical List of Advertisers.

The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks; the parallel (‖) three times out of four.

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ÆTNA & CORLISS ROLLING MILL ENGINES
THE TOTTEN & HOGG IRON & STEEL FOUNDRY CO.
OFFICE & WORKS
24TH ST. & A.V.R.R.
PITTSBURGH, PA
PINIONS, CHILLED & SAND ROLLS.
ROCK CRUSHERS
ROLLING MILL & TIN PLATE MILL MACHINERY

Tin Plate Mills and Machinery

ROLLING MILL MACHINERY, CHILLED AND SAND ROLLS.

"ZERO" Highest grade Anti-Friction Metal. Estimates given on complete plants.

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THE LORAIN FOUNDRY COMPANY,

Lorain, Ohio.

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Heavy Iron Castings in Loam, Dry and Green Sand, Made from Cupola or Air Furnace...

BRASS AND COPPER CASTINGS.

Everything Runs Smoothly

In the engine room governed by an AUSTIN SEPARATOR —No foaming in boiler, no pounding in cylinder, no sour tempered engineer.

Our catalogue will interest you

AUSTIN SEPARATOR CO.,

18-23 Woodbridge St.,

DETROIT, - MICH.

Largest Dimensions. Highest Quality.

STEEL CASTINGS.

We are thoroughly equipped to meet all Specifications.

CORRESPONDENCE SOLICITED.

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BRANCH OFFICES:
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National Tube Works Company,

MILLS AT McKEESPORT, PA.

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Hydraulic Pressed Forging.

WYMAN & GORDON, Worcester, Mass.
New York Office: 116 Liberty st.

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Not every insertion of every advertiser's card brings an order for the advertiser's good; no more does every visit of the traveling salesman result in a sale.

There is a vast deal in familiarity with the type and phrase in which a manufacturer makes himself known to the advertisement reader, just as the personal acquaintance of his traveling salesman gets him a hearing when a strange face and a strange voice are bowed out with a "busy day's" courtesies.

The best advertisers, the most successful advertisers, the advertisers who get returns, are those who keep everlastingly at it.

This is a case in which familiarity breeds business.

Now is the time for you to spread out.

Extend your business and create a demand for your devices in new fields.

The man who whispers down a well,
About the things he has to sell,
Won't reap the golden dollars,
Like one who climbs a tree and—hollers.—Ex.

The Iron Trade Review is the best trade advertising medium in the Central West.

Has the largest paid circulation in its territory.

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Spearman Iron Company,

Sharpsville, Pa.

Inspected Foundry Irons. Softness, Strength, Fluidity, Uniformity.

American Scotch

Brand unequaled.

HENDERSON & TRAGO, Agents,
CLEVELAND, O

Absolutely without a rival.

Perfect Lubricating Metal.

The only Phosphorized Tin Graphite Bearing Metal in the world. Write for particulars. Ask your dealers for it.

Perfect Lubricating Metal Co.,

Second and Plum Sts.,
Cincinnati, Ohio, U. S. A.

THE
DANIELSON MACHINE AND TOOL COMPANY,

DEALERS IN

MACHINERY and Machine Tools

MANUFACTURERS OF
DIES,
Special Machinery, Etc.
Special Department for
DEVELOPING INVENTIONS
in SECRET.

A full line of
NEW and SECOND HAND PRESSES and MACHINE TOOLS
carried in stock

93 to 97 Lake St., Cleveland, O.

DETROIT
Emery-Corundum
WHEELS,
Sellers' Tool and Twist Drill Grinders.

J. WENDELL COLE,

P. O. Box 84, COLUMBUS, OHIO.
911 No. 112 Clark St., CHICAGO, ILL.

Radial Drills,

FOR EVERY CLASS OF WORK. 1899 Catalog Describes Them.

BAUSH & HARRIS MACHINE TOOL CO.,
Springfield, Mass., U. S. A.

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HILL, CLARK & CO.,
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EUROPEAN AGENTS:
SELIG SONNENTHAL & CO.,
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E. SONNENTHAL, Jr.,
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MEEHAN VERTICAL WATER TUBE BOILER.
The Best Boiler for Utilizing Waste Gases Around Blast Furnaces and Rolling Mills.
We Make a Specialty of Repair and Renewal Work at Plants.
THE MEEHAN BOILER & CONSTUCTION CO.,
Lowellville, Ohio.

The "ORIGINAL GANDY"
Stitched Cotton Duck Belting,
Especially adapted for Main Drivers, Saw Mills, Cotton Gins, Cotton Presses, and for all places where belts are subjected to moisture or atmospheric changes, the "GANDY" stands paramount.
For farther information, prices, etc., write
The GANDY BELTING CO., Baltimore, Md.

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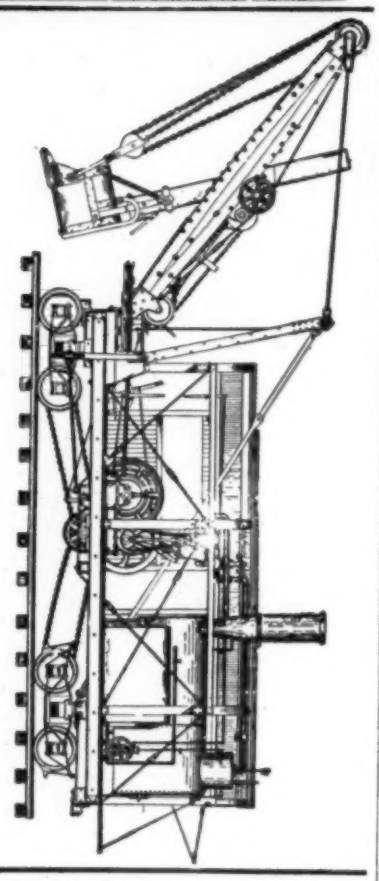
FOR
Iron Mining.

We have machines of new designs with hoisting, swinging and crane engines. These were designed and constructed especially to meet requirements of iron mining and coal mining fields.

WE INVITE MOST RIGID INVESTIGATION.

For full information address
THE
MARION STEAM SHOVEL CO.
Marion, Ohio.



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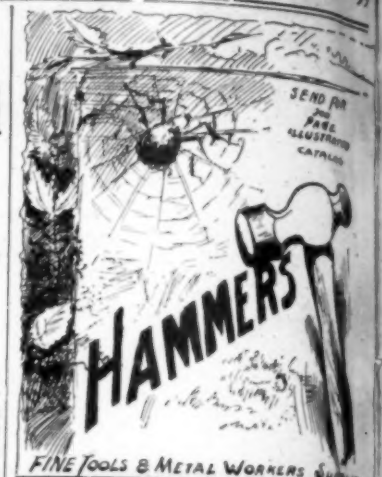

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CHICAGO, ILL. U.S.A.

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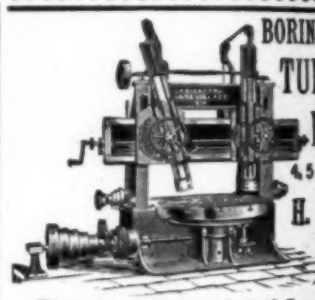

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Write for Photograph and Low Prices.

Fire Brick, Fire Clay, Pig Iron.
F. B. STEVENS, Detroit, Mich.

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A large and growing circulation among machine shop and foundry firms has
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Estimates made from drawings. Working drawings prepared.
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